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FIRST PICTURE OF MOUNT RAINIER.
Drawn by W. Alexander from a sketch by J. Sykes, 1792. Engraved by J. Landseer for Vancouver's Journal.

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Mount Rainier

A Record of Exploration

Edited by

Edmond S. Meany

Professor of History in the University of Washington. President of The Mountaineers

Author of "Vancouver's Discovery of Puget Sound"
"History of the State of Washington,"
etc.

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To

GENERAL HAZARD STEVENS

EARLY LOVER OF THE MOUNTAIN, THIS BOOK

IS AFFECTIONATELY DEDICATED

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PREFACE

MOUNT RAINIER NATIONAL PARK is visited annually by increasing thousands of tourists. Many of them seek information about the discoveries and explorations of the mountain and its environs. Much of the information sought, especially that about the origin of place names, has never been published. The annals of discovery and exploration, which have been published, have often appeared in books, pamphlets, or periodicals not easily accessible. It is the purpose of this work to gather the essential portions of the desired information within a compact, usable form.

During the summer of 1915, the mountain was for the first time encircled by a large company of travelers. Small parties, carrying their luggage and provisions on their backs, had made the trip a number of times. The Mountaineers Club, in 1915, conducted a party of one hundred, with fully equipped pack train and commissary, around the mountain. They camped each evening at or near the snow-line. At the daily campfires extracts were read from the original sources of the mountain's history. The interest there manifested in such records gave additional impulse to the preparation of this book.

It is natural that the chronological order should be chosen in arranging the materials, beginning with the discovery and naming of the mountain by Captain George Vancouver of the British Navy. The records are then continued to the present time. There still remains to be done much scientific work on the glaciers, snowfields, rocks, and plants within the Park. It is hoped that this book may stimulate such field work as well as the publication of the results.

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The reader will notice that several writers in referring to the mountain use some form of the name Tacoma. The editor has not hesitated to publish such names as were used in the original articles here reproduced. In all other cases he has used the name Mount Rainier, approved by the United States Geographic Board.

In the separate chapters it will be noticed that the height of the mountain has been placed at varying figures. The United States Geological Survey has spoken on this subject with apparent official finality, giving the altitude as 14,408 feet above sea level. How this height was determined is told in the official announcement reproduced in Chapter XVIII of the text, with comment thereon by F. E. Matthes, one of the engineers of the United States Geological Survey.

The place names within the Park have been derived from such varied sources that it is well-nigh impossible to ascertain the origin and meaning of all of them. For the first time they are here (Chapter XIX) gathered into a complete alphabetical arrangement with as full information as is now available. The writer would welcome further facts about any of the names.

In the introductory paragraphs before each chapter, the editor has sought to express his acknowledgment for assistance rendered by others in the compilation of the work. For fear some may have been omitted he wishes here to express gratitude for all such help and to mention especially Professor J. Franklin Jameson, Director of the Department of Historical Research of the Carnegie Institution of Washington, for his assistance in securing photostat reproductions of a number of rare items found in the Library of Congress.

The editor also acknowledges the assistance rendered by Victor J. Farrar, research assistant in the University of Washington.

EDMOND S. MEANY.

UNIVERSITY OF WASHINGTON,
Seattle, August, 1916.

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CAPTAIN GEORGE VANCOUVER.
Royal Navy.

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MOUNT RAINIER

A RECORD OF EXPLORATIONS

I. THE MOUNTAIN DISCOVERED AND NAMED, 1792

By CAPTAIN GEORGE VANCOUVER, R.N.

Captain George Vancouver, the great English navigator and explorer, lived but forty years, from 1758 to 1798. He entered the British navy on the *Resolution* under Captain James Cook in 1771 and was with that even more famous explorer during his second and third voyages, from 1772 to 1780. He was placed in command of the *Discovery* and *Chatham* in 1791 and sent to the northwest coast of America. On this voyage he discovered and named Puget Sound and many other geographic features on the western coast of America.

The portions of his Voyage of Discovery to the North Pacific Ocean, giving the record of his discovery, naming, and exploration in the vicinity of Mount Rainier, are taken from Volume II of the second edition, published in London in 1801, pages 79, 118, and 134–138.

[Tuesday, May 8, 1792.] The weather was serene and pleasant, and the country continued to exhibit, between us and the eastern snowy range, the same luxuriant appearance. At its northern extremity, mount Baker bore by compass N. 22 E.; the round snowy mountain, now forming its southern extremity, and which, after my friend Rear Admiral Rainier, I distinguished by the name of Mount Rainier, bore N. [S.] 42 E.

[Saturday, May 19, 1792.] About noon, we passed an inlet on the larboard or eastern shore, which seemed to stretch far to the northward; but, as it was out of the

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line of our intended pursuit of keeping the continental shore on board, I continued our course up the main inlet, which now extended as far as, from the deck, the eye could reach, though, from the mast-head, intervening land appeared, beyond which another high round mountain covered with snow was discovered, apparently situated several leagues to the south of mount Rainier, and bearing by compass S. 22 E. This I considered as a further extension of the eastern snowy range; but the intermediate mountains, connecting it with mount Rainier, were not sufficiently high to be seen at that distance.

[Saturday, May 26, 1792.] Towards noon we landed on a point on the eastern shore, whose latitude I observed to be 47° 21′, round which we flattered ourselves we should find the inlet take an extensive eastwardly course. This conjecture was supported by the appearance of a very abrupt division in the snowy range of mountains immediately to the south of mount Rainier, which was very conspicuous from the ship, and the main arm of the inlet appearing to stretch in that direction from the point we were then upon. We here dined, and although our repast was soon concluded, the delay was irksome, as we were excessively anxious to ascertain the truth, of which we were not long held in suspense. For having passed round the point, we found the inlet to terminate here in an extensive circular compact bay, whose waters washed the base of mount Rainier, though its elevated summit was yet at a very considerable distance from the shore, with which it was connected by several ridges of hills rising towards it with gradual ascent and much regularity. The forest trees, and the several shades of verdure that covered the hills, gradually decreased in point of beauty, until they became invisible; when the perpetual clothing of snow commenced, which seemed to form a horizontal line from north to south along this range of rugged mountains,

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from whose summit mount Rainier rose conspicuously, and seemed as much elevated above them as they were above the level of the sea; the whole producing a most grand, picturesque effect. The lower mountains, as they descended to the right and left, became gradually relieved of their frigid garment; and as they approached the fertile woodland region that binds the shores of this inlet in every direction, produced a pleasing variety. We now proceeded to the N. W. in which direction the inlet from hence extended, and afforded us some reason to believe that it communicated with that under the survey of our other party. This opinion was further corroborated by a few Indians, who had in a very civil manner accompanied us some time, and who gave us to understand that in the north western direction this inlet was very wide and extensive; this they expressed before we quitted our dinner station, by opening their arms, and making other signs that we should be led a long way by pursuing that route; whereas, by bending their arm, or spreading out their hand, and pointing to the space contained in the curve of the arm, or between the fore-finger and thumb, that we should find our progress soon stopped in the direction which led towards mount Rainier. The little respect which most Indians bear to truth, and their readiness to assert what they think is most agreeable for the moment, or to answer their own particular wishes and inclinations, induced me to place little dependance on this information, although they could have no motive for deceiving us.

About a dozen of these friendly people had attended at our dinner, one part of which was a venison pasty. Two of them, expressing a desire to pass the line of separation drawn between us, were permitted to do so. They sat down by us, and ate of the bread, and fish that we gave them without the least hesitation; but on being offered some of the venison, though they saw us eat it with great relish, they could not be induced to

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taste it. They received it from us with great disgust, and presented it round to the rest of the party, by whom it underwent a very strict examination. Their conduct on this occasion left no doubt in our minds that they believed it to be human flesh, an impression which it was highly expedient should be done away. To satisfy them that it was the flesh of the deer, we pointed to the skins of the animal they had about them. In reply to this they pointed to each other, and made signs that could not be misunderstood, that it was the flesh of human beings, and threw it down in the dirt, with gestures of great aversion and displeasure. At length we happily convinced them of their mistake by shewing them a haunch we had in the boat, by which means they were undeceived, and some of them ate of the remainder of the pye with a good appetite.

This behavior, whilst in some measure tending to substantiate their knowledge or suspicions that such barbarities have existence, led us to conclude, that the character given of the natives of North-West America does not attach to every tribe. These people have been represented not only as accustomed inhumanly to devour the flesh of their conquered enemies; but also to keep certain servants, or rather slaves, of their own nation, for the sole purpose of making the principal part of the banquet, to satisfy the unnatural savage gluttony of the chiefs of this country, on their visits to each other. Were such barbarities practiced once a month, as is stated, it would be natural to suppose these people, so inured, would not have shewn the least aversion to eating flesh of any description; on the contrary, it is not possible to conceive a greater degree of abhorrence than was manifested by these good people, until their minds were made perfectly easy that it was not human flesh we offered them to eat. This instance must necessarily exonerate at least this particular tribe from so barbarous a practice; and, as their affinity to the inhabitants of Nootka, and of

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the sea-coast, to the south of that place, in their manners and customs, admits of little difference, it is but charitable to hope those also, on a more minute inquiry, may be found not altogether deserving such a character. They are not, however, free from the general failing attendant on a savage life. One of them having taken a knife and fork to imitate our manner of eating, found means to secrete them under his garment; but, on his being detected, gave up his plunder with the utmost good humour and unconcern.

They accompanied us from three or four miserable huts, near the place where we had dined, for about four miles; during which time they exchanged the only things they had to dispose of, their bows, arrows, and spears, in the most fair and honest manner, for hawk's bells, buttons, beads, and such useless commodities.

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II. FIRST APPROACH TO THE MOUNTAIN, 1833

By DOCTOR WILLIAM FRASER TOLMIE

Doctor William Fraser Tolmie was a medical officer in the service of the Hudson's Bay Company. He was born at Inverness, Scotland, on February 3, 1812, and died at Victoria, British Columbia, on December 8, 1888. He was educated at Glasgow, and when twenty years of age he joined the Hudson's Bay Company. In 1833, he was located at Nisqually House, Puget Sound. It was then that he made his trip to the mountain. He later served at other posts in the Pacific Northwest, and was raised to the rank of Chief Factor in 1856. He was then placed on the board of management of the great company. In 1860 he retired from the service.

In 1850 he was married to Jane, eldest daughter of Chief Factor John Work. Their descendants still live at Victoria, British Columbia. They, especially the son John W. Tolmie, have compared this reproduction from Doctor Tolmie's diary with the original manuscript to insure accuracy. So far as is now known, this is the first record of a white man's close approach to Mount Rainier.

It is pleasant to note that the new map of Mount Rainier National Park, published by the United States Geological Survey, shows the peak he climbed and the creek flowing near it bearing the name of Tolmie.

August 27, 1833. Obtained Mr. Herron's consent to making a botanizing excursion to Mt. Rainier, for which he has allowed 10 days. Have engaged two horses from a chief living in that quarter, who came here tonight, and Lachalet is to be my guide. Told the Indians I am going to Mt. Rainier to gather herbs of which to make medicine, part of which is to be sent to Britian and part retained in case intermittent fever should visit us when I will prescribe for the Indians.

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DOCTOR WILLIAM FRASER TOLMIE.

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Aug. 28. A tremendous thunder storm occurred last night, succeeded by torrents of rain. The thunder was very loud, and the lightening flashing completely enlightened my apartment. Have been chatting with Mr. Herron about colonizing Whidby's island, a project of which he is at present quite full — more anon. No horses have appeared. Understand that the mountain is four days' journey distant — the first of which can only be performed on horseback. If they do not appear tomorrow I shall start with Lachalet on foot.

Aug. 29. Prairie 8 miles N. of home. Sunset. Busy making arrangements for journey, and while thus occupied the guide arrived with 3 horses. Started about 3, mounted on a strong iron grey, my companions disposing of themselves on the other two horses, except one, who walked. We were 6 in number. I have engaged Lachalet for a blanket, and his nephew, Lashima, for ammunition to accompany me and Nuckalkut a Poyalip (whom I took for a native of Mt. Rainier) with 2 horses to be guide on the mountain after leaving the horse track, and Quilniash, his relative, a very active, strong fellow, has volunteered to accompany me. The Indians are all in great hopes of killing elk and chevriel, and Lachalet has already been selling and promising the grease he is to get. It is in a great measure the expectation of finding game that urges them to undertake the journey. Cantered slowly along the prairie and are now at the residence of Nuckalkut's father, under the shade of a lofty pine, in a grassy amphitheatre, beautifully interspersed and surrounded with oaks, and through the gaps in the circle we see the broad plain extending southwards to Nusqually. In a hollow immediately behind is a small lake whose surface is almost one sheet of waterlilies about to flower. Have supped on sallal; and at dusk shall turn in.

Aug. 30. Sandy beach of Poyallipa River. Slept

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ill last night, and as I dozed in the morning was aroused by a stroke across the thigh from a large decayed branch which fell from the pine overshadowing us. A drizzling rain fell during most of the night. Got up about dawn, and finding thigh stiff and painful thought a stop put to the journey, but after moving about it felt easier. Started about sunrise, I mounted on a spirited brown mare, the rest on passable animals, except Nuckalkut, who bestrode a foal. Made a northeasterly course through prairie. Breakfasted at a small marsh on bread, sallal, dried cockels and a small piece of chevriel saved from the last night's repast of my companions (for I cannot call them attendants). The points of wood now became broader, and the intervening plain degenerated into prairions. Stopped about 1 P.M. at the abode of 3 Tekatat families, who met us rank and file at the door to shake hands. Their sheds were made of bark resting on a horizontal pole, supported at each end by tripods, and showed an abundance of elk's flesh dried within. Two kettles were filled with this, and, after smoking, my Indians made a savage repast on the meat and bouillion, Lachalet saying it was the Indian custom to eat a great deal at once and afterwards abstain for a time; he, however, has twice eaten since. Traded some dried meat for 4 balls and 3 rings, and mounting, rode off in the midst of a heavy shower. Ascended and descended at different times several steep banks and passed through dense and tangled thickets, occasionally coming on a prairion. The soil throughout was of the same nature as that of Nusqually. After descending a very steep bank came to the Poyallip. Lashima carried the baggage across on his head. Rode to the opposite side through a rich alluvial plain, 3 or 4 miles in length and ¾ to 1 in breadth. It is covered with fern about 8 feet high in some parts. Passed through woods and crossed river several times. About 7 P.M. dismounted and the horses and accoutre-

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ments were left in a wood at the river's brink. Started now on foot for a house Nuckalkut knew, and after traversing woods and twice crossing the torrents "on the unsteadfast footing" of a log, arrived at the house, which was a deserted one, and encamped on the dry part of river's bed, along which our course lies tomorrow. The Poyallip flows rapidly and is about 10 or 12 yards broad. Its banks are high and covered with lofty cedars and pines. The water is of a dirty white colour, being impregnated by white clay. Lachalet has tonight been trying to persuade me from going to the snow on the mountain.

Aug. 31. Slept well, and in the morning two salmon were caught, on which we are to breakfast before starting. After breakfast Quillihaish stuck the gills and sound of the fish on a spit which stood before the fire, so that the next comer might know that salmon could be obtained there. Have traveled nearly the whole day through a wood of cedar and pine, surface very uneven, and after ascending the bed of river a couple of miles are now encamped about ten yards from its margin in the wood. Find myself very inferior to my companions in the power of enduring fatigue. Their pace is a smart trot which soon obliges me to rest. The waters of the Poyallip are still of the same colour. Can see a short distance up two lofty hills covered with wood. Evening cloudy and rainy. Showery all day.

Sunday, Sept. 1. Bank of Poyallip river. It has rained all night and is now, 6 A.M., pouring down. Are a good deal sheltered by the trees. My companions are all snoozing. Shall presently arouse them and hold a council of war. The prospect is very discouraging. Our provisions will be expended today and Lachalet said he thought the river would be too high to be fordable in either direction. Had dried meat boiled in a cedar bark kettle for breakfast. I got rigged out in green blanket without trousers, in In-

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dian style, and trudged on through the wood. Afterwood exchanged blanket with Lachalet for Ouvrie's capot, which has been on almost every Indian at Nusqually. However, I found it more convenient than the blanket. Our course lay up the river, which we crossed frequently. The bed is clayey in most parts. Saw the sawbill duck once or twice riding down on a log and fired twice, unsuccessfully. Have been flanked on both sides with high, pineclad hills for some time. A short distance above encampment snow can be seen. It having rained almost incessantly, have encamped under shelving bank which has been undermined by the river. Immense stones, only held in situ by dried roots, form the roof, and the floor is very rugged. Have supped on berries, which, when heated with stones in kettle, taste like lozenges. Propose tomorrow to ascend one of the snowy peaks above.

Sept. 2. Summit of a snowy peak immediately under Rainier. Passed a very uncomfortable night in our troglodytic mansion. Ascended the river for 3 miles to where it was shut in by amphitheatre of mountains and could be seen bounding over a lofty precipice above. Ascended that which showed most snow. Our track lay at first through a dense wood of pine, but we afterwards emerged into an exuberantly verdant gully, closed on each side by lofty precipices. Followed fully to near the summit and found excellent berries in abundance. It contained very few Alpine plants. Afterwards came to a grassy mound, where the sight of several decayed trees induced us to encamp. After tea I set out with Lachalet and Nuckalkut for the summit, which was ankle deep with snow for ¼ mile downwards. The summit terminated in abrupt precipice directed northwards and bearing N. E. from Mt. Rainier, the adjoining peak. The mists were at times very dense, but a puff of S. W. wind occasionally dispelled them. On the S. side of Poyallip is a range of snow-dappled mountains, and they, as well as that

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on the N. side, terminate in Mt. Rainier, a short distance to E. Collected a vasculum of plants at the snow, and having examined and packed them shall turn in. Thermometer at base, 54 deg., at summit of ascent, 47 deg.

Sept. 3. Woody islet on Poyallip. It rained heavily during night, but about dawn the wind shifting to the N. E. dispersed the clouds and frost set in. Lay shivering all night and roused my swarthy companions twice to rekindle the fire. At sunrise, accompanied by Quilliliash, went to the summit and found the tempr. of the air 33 deg. The snow was spangled and sparkled brightly in the bright sunshine. It was crisp and only yielded a couple of inches to the pressure of foot in walking. Mt. Rainier appeared surpassingly splendid and magnificent; it bore, from the peak on which I stood, S. S. E., and was separated from it only by a narrow glen, whose sides, however, were formed by inaccessible precipices. Got all my bearings more correctly to-day, the atmosphere being clear and every object distinctly perceived. The river flows at first in a northerly direction from the mountain. The snow on the summit of the mountain adjoining Rainier on western side of Poyallip is continuous with that of latter, and thus the S. Western aspect of Rainier seemed the most accessible. By ascending the first mountain through a gully in its northern side, you reach the eternal snow of Rainier, and for a long distance afterwards the ascent is very gradual, but then it becomes abrupt from the sugar-loaf form assumed by the mountain. Its eastern side is steep on its northern aspect; a few glaciers were seen on the conical portion; below that the mountain is composed of bare rock, apparently volcanic, which about 50 yards in breadth reaches from the snow to the valley beneath and is bounded on each side by bold bluff crags scantily covered with stunted pines. Its surface is generally smooth, but here and there raised

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into small points or knobs or arrowed with short and narrow longitudinal lines in which snow lay. From the snow on western border the Poyallipa arose, and in its course down this rock slope was fenced into the eastward by a regular elevation of the rock in the form of a wall or dyke, which at the distance I viewed it at, seemed about four feet high and four hundred yards in length. Two large pyramids of rock arose from the gentle acclivity at S. W. extremity of mountain, and around each the drifting snow had accumulated in large quantity, forming a basin apparently of great depth. Here I also perceived, peeping from their snowy covering, two lines of dyke similar to that already mentioned.

Sept. 4. Am tonight encamped on a small eminence near the commencement of prairie. Had a tedious walk through the wood bordering Poyallip, but accomplished it in much shorter time than formerly. Evening fine.

Sept. 5. Nusqually. Reached Tekatat camp in the forenoon and regaled on boiled elk and shallon. Pushed on ahead with Lachalet and Quilliliash, and arrived here in the evening, where all is well.

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COMMANDER CHARLES WILKES.
United States Navy.

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III. FIRST RECORDED TRIP THROUGH NACHES PASS, 1841

By LIEUTENANT ROBERT E. JOHNSON, U.S.N.

The proper and official title of the United States Exploring Expedition, 1838–1842, by common speech has been contracted to the Wilkes Expedition. The commander of the expedition was Charles Wilkes, who entered the United States Navy as a midshipman on January 1, 1818. On July 25, 1866, he was promoted to rear-admiral on the retired list. He was born at New York City on April 3, 1798, and died at Washington City on February 8, 1877.

He was honored in Europe and America for his scientific attainments, especially in connection with the expedition that now bears his name. That voyage with a squadron of American naval vessels was for the purpose of increasing the world's knowledge of geography and kindred sciences. They reached Puget Sound in 1841 and, while making headquarters at Nisqually House of the Hudson's Bay Company, Commander Wilkes sent Lieutenant Robert E. Johnson in command of a party to cross the Cascade Range. Search in the Navy Department revealed only scant information that Lieutenant Johnson was from North Carolina. The Historical Commission of that State and others there have failed to find information about his subsequent career.

Since he speaks of obtaining a guide, it is likely that he was not the first white man to cross the Cascades, but he was the first to leave us a known record. The portions of that record which bear upon Mount Rainier and its environs is here reproduced.

Commander Wilkes, before giving the record of his subordinate, makes reference to the peak as follows: "The height of Mount Rainier was obtained by measuring a base line on the prairies, in which operation I was assisted by Lieutenant Case, and the triangulation gave its height, twelve thousand three hundred and thirty feet." (Narrative, Volume IV., page 413.)

The final reports of the expedition were to appear in twenty-four large volumes and eleven atlases. Several of the volumes were never published, and of those completed only one hundred sets were printed. The rare monographs were full of information.

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MOUNT RAINIER

The first part or "Narrative" in five volumes was issued in several editions. The portions here reproduced are taken from the edition by Lea and Blanchard, Philadelphia, 1845, Volume IV., pages 418–429 and 468–470.

I have before stated that Lieutenant Johnson's party was ready for departure on the 19th May [1841]; that it consisted of Lieutenant Johnson, Messrs. Pickering, Waldron, and Brackenridge, a sergeant of marines, and a servant. I must do justice to the exertions of this officer in getting ready for his journey, which he accomplished in less time than I anticipated, as the delays incident to setting out on a novel expedition, and one believed by most persons to be scarcely practicable in the summer season, are great and tantalizing. In making preparations for such a journey, the Indians were to be bargained with, and, as I have before had occasion to remark, are enough to tire the patience of Job himself. First, the Indian himself is to be sought out; then the horse is to be tried; next the price is to be discussed, then the mode of payment, and finally the potlatch: each and all are matters of grave consideration and delay, during which the Indians make a business of watching every circumstance of which they can take advantage. No one can be sure of closing his bargain, until the terms are duly arranged, the potlatch given, and the horse delivered. After obtaining horses, Lieutenant Johnson had the saddles, alforcas, saddle-cloths, saddle-trees or pack-saddles, etc., with a variety of lashings, to prepare. For many of these we were indebted to the kindness of Captain M'Niel and Mr. Anderson.[1] Others were made on board the ship, after a pattern lent us. One of the most important persons to obtain was a good guide, and hearing of one who resided at the Cowlitz river, by the name

[1] Captain William Henry McNeill and Alexander Caulfield Anderson, Hudson's Bay Company men, then at Nisqually House. Captain McNeill was master of the famous old steamer *Beaver*. Mr. Anderson was in charge of Nisqually House. Both men were honored by having their names given to islands in Puget Sound.

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of Pierre Charles,[1] he was at once sent for; but I did not think it worth while to detain the party until his arrival, as he could easily overtake it. Lieutenant Johnson, therefore, was directed to hurry his departure, and to set out, which he did on the 19th May, at noon, and proceeded to the prairie about two miles distant, where the party encamped.

There is little danger on these expeditions of having too few articles: the great difficulty is to avoid having too many. It turned out as I had anticipated. The first night passed in their tent fully satisfied them of this, and taught them to dispense with all other bedding save blankets.

Mr. Anderson rode to the encampment before night, bringing the news of the arrival of Pierre Charles at the fort; whereupon Lieutenant Johnson returned to make an agreement with him and his companion. This was done, although, as is to be supposed, their demands were exorbitant, in consequence of the belief that their services were indispensable.

Pierre Charles's companion was a young man, named Peter Bercier, (a connexion of Plumondon) [2] who spoke English, and all the languages of the country.

On the morning of the 20th, they obtained an accession to their horses, and set out on their route towards the mountains. Although the possibility of crossing them was doubted, yet I felt satisfied if exertion and perseverance could effect the object, the officer who had charge of the party would succeed. This day, they made but five miles; after which they encamped, at the recommendation of Pierre Charles, in order that the horses might not be over-fatigued, and be able to get good pasture and water. Here a number of natives visited the camp. Pine trees were in large numbers, many of them upwards of one hundred and thirty feet

[1] Pierre Charles, French Canadian, had been an employee of the Hudson's Bay Company.

[2] Simon Plomondon was an employee of the Hudson's Bay Company, who retired and settled in the Cowlitz Valley.

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in height. On the banks of a small stream, near their camp, were found the yellow Ranunculus, a species of Trillium, in thickets, with large leaves and small flowers, Lupines, and some specimens of a cruciferous plant.

On the 21st they made an early start, and in the forenoon crossed the Puyallup, a stream about seventy feet wide; along which is a fine meadow of some extent, with clumps of alder and willow: the soil was of a black turfy nature. After leaving the meadow-land, they began to ascend along a path that was scarcely visible from being overgrown with Gaultheria, Hazel, Spiræa, Vaccinium, and Cornus.

During the day, they crossed the Stehna.[1] In the evening, after making sixteen miles, they encamped at the junction of the Puyallup with the Upthascap.[2] Near by was a hut, built of the planks of the Arbor Vitæ (Thuja), which was remarkably well made; and the boards used in its structure, although split, had all the appearance of being sawn: many of them were three feet wide, and about fifteen feet long. The hut was perfectly water-tight. Its only inhabitants were two miserable old Indians and two boys, who were waiting here for the arrival of those employed in the salmon-fishery. The rivers were beginning to swell to an unusual size, owing to the melting of the snows in the mountains; and in order to cross the streams, it became necessary to cut down large trees, over which the packs were carried, while the horses swam over. These were not the only difficulties they had to encounter: the path was to be cut for miles through thickets of brushwood and fallen timber; steep precipices were to be ascended, with slippery sides and entangled with roots of every variety of shape and size, in which the horses' legs would become entangled, and before reaching the top be precipitated, loads and all, to the bottom. The horses would at times become

[1] Probably the Stone Creek of present usage. [2] Carbon River.

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jammed with their packs between trees, and were not to be disengaged without great toil, trouble, and damage to their burdens. In some cases, after succeeding in getting nearly to the top of a hill thirty or forty feet high, they would become exhausted and fall over backwards, making two or three somersets, until they reached the bottom, when their loads were again to be arranged.

On the 22d, their route lay along the banks of the Upthascap,[1] which is a much wider stream than the Puyallup. A short distance up, they came to a fish-weir, constructed as the one heretofore described, on the Chickeeles,[2] though much smaller.

This part of the country abounds with arbor-vitæ trees, some of which were found to be thirty feet in circumference at the height of four feet from the ground, and upwards of one hundred feet high. Notwithstanding the many difficulties encountered, they this day made about twelve miles.

On the morning of the 23d, just as they were about to leave their camp, their men brought in a deer, which was soon skinned and packed away on the horses. This was the first large game they had obtained, having previously got only a few grouse.

They had now reached the Smalocho,[3] which runs to the westward, and is sixty-five feet wide: its depth was found to be four and a half feet, which, as it was also rapid, was too great for the horses to ford and carry their loads. The Indians now became serviceable to them. Lieutenant Johnson had engaged several that were met on their way, and they now amounted to thirteen, who appeared for a time lively and contented. This, however, was but a forerunner of discontent, and a refusal to go any farther; but with coaxing and threatening they were induced to proceed.

The road or way, after passing the river, was over a

[1] Meaning up the Carbon River and its branch called South Prairie Creek.
[2] Chehalis River. [3] White River.

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succession of deep valleys and hills, so steep that it was difficult for a horse to get up and over them with a load, and the fall of a horse became a common occurrence. They were all, however, recovered without injury, although one of them fell upwards of one hundred feet; yet in consequence of his fall having been repeatedly broken by the shrubs and trees, he reached the bottom without injury to himself, but with the loss of his load, consisting of their camp utensils, &c., which were swept off by the rapid current of the river.

The route lay, for several days, through forests of spruce, and some of the trees that had fallen measured two hundred and sixty-five feet in length. One of these, at the height of ten feet from the roots, measured thirty-five feet in circumference, and at the end which had been broken off in its fall, it was found to be eighteen inches in diameter, which would make the tree little short of three hundred feet when it was growing. The stems of all these trees were clear of branches to the height of one hundred and fifty feet from the ground, and perfectly straight. In many cases it was impossible to see over the fallen trees, even when on horseback, and on these, seedlings were growing luxuriantly, forcing their roots through the bark and over the body of the trunk till they reached the ground. Many spruces were seen which had grown in this way; and these, though of considerable size, still retained the form of an arch, showing where the old tree had lain, and under which they occasionally rode. As may be supposed, they could not advance very rapidly over such ground, and Lieutenant Johnson remarks, that although he was frequently desirous of shortening the road, by taking what seemed a more direct course, he invariably found himself obliged to return to the Indian trail.

Daylight of the 24th brought with it its troubles: it was found that the horses had strayed, — a disaster that the Indians took quite coolly, hoping it would be

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the cause of their return. After a diligent search, the horses were found in places where they had sought better food, although it was scanty enough even there.

During the day, the route led along the Smalocho,[1] which runs nearly east and west; and they only left its banks when they were obliged to do so by various impassable barriers. This part of the country is composed of conical hills, which are all thickly clothed with pine trees of gigantic dimensions. They made nine miles this day, without accident; but when they encamped, they had no food for the horses except fern. The animals, in consequence, seemed much overcome, as did also the Indians, who had travelled the whole day with heavy loads. Lieutenant Johnson, by way of diverting the fatigue of the latter, got up a shooting-match for a knife, the excitement of which had the desired effect.

The trees hereabout were chiefly the cotton-wood, maple, spruce, pine, and elder, and some undergrowth of raspberry, the young shoots of which the natives eat with great relish.

On the 25th, they set out at an early hour, and found the travelling less rough, so that they reached the foot of La Tête[2] before noon, having accomplished eleven miles. Lieutenant Johnson with the sergeant ascended La Tête, obtained the bearings, from its summit, of all the objects around, and made its height by barometer, two thousand seven hundred and ninety-eight feet: its latitude was fixed at 47° 08′ 54″ N. This mountain was entirely destitute of wood; but, having been burnt over, was found strewn with huge charred trunks, and the whole ground covered with ashes. The inclination of its sides was about fifty degrees.

[1] White River.

[2] Lieutenant Richard Arnold, in Pacific Railway Reports, Volume XII, Part I, page 191, says: "Near the junction of Whitewater and Green rivers there is a remarkable peak called La Tête, from a large rock on its slope resembling the head and neck of a man. This is an important point, as it forms the gate of the mountains on the west." Modern maps shift the "water" part of the names. They are now White and Greenwater rivers.

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The country around seemed one continued series of hills, and like La Tête had suffered from the fire. According to the natives, although the wood on the mountains was destroyed many years since, yet it was still observed to be on fire, in some places, about two years ago. Most of the tops of the distant peaks had snow on them. To the east was seen the appearance of two valleys, through which the two branches of the Smalocho [1] flow.

On descending from La Tête, the river was to be crossed: this was found too deep to be forded, and it consequently became necessary to form a bridge to transport the baggage, by cutting down trees. The current was found to run 6·2 miles per hour. They had been in hopes of reaching the Little Prairie before night, but in consequence of this delay, were forced to encamp before arriving there.

The Indians complained much of the want of food: many of the horses also were exhausted for the same cause, and exhibited their scanty nourishment in their emaciated appearance.

On the 26th, they reached the Little Prairie at an early hour, where, after consultation, it was determined to wait a day to recruit the horses, as this was the only place they could obtain food. It was also desirable to ascertain the practicability of passing the mountain with the horses, and at the same time to carry forward some of the loads, that the horses might have as little as possible to transport. Mr. Waldron and Pierre Charles were therefore sent forward with the Indians, having loads of fifty pounds each, to ascend the mountain, while Lieutenant Johnson remained with the camp to get observations. Dr. Pickering and Mr. Brackenridge accompanied the party of Mr. Waldron to the snow-line. The prairie on which they had encamped was about two and a half acres in extent, and another of the same size was found half a mile farther east.

[1] White and Greenwater rivers.

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The 27th was employed by Lieutenant Johnson in determining the positions of this prairie, which proved to be in latitude 47° 05′ 51″ N., and longitude 120° 13′ W.[1] The variation was 19° 39′ easterly. At sunset, messengers arrived from Mr. Waldron, who had reached the summit at noon, and was to proceed down to the snow-line to encamp. The snow was found to be about ten feet deep, and the party crossing sank about ankle-deep, for which reason opinions varied as to the possibility of getting the horses over; but it was determined to make the trial. Lieutenant Johnson, therefore, set out, leaving a supply of food with an old Indian and a horse, both of whom were worn out, and unable to proceed.

By eleven o'clock, they were met by Pierre Charles and the Indians, who gave some slight hopes of accomplishing the task of getting all over. Lieutenant Johnson determined to take only the strongest horses to the edge of the snow. At half-past 5 P.M., they reached the best practicable encampment, being a mile beyond the place where Mr. Waldron had encamped two days before. The snow having melted so rapidly, Lieutenant Johnson, taking all things into consideration, determined, notwithstanding the forebodings of failure held out by the party that had gone before, to make the attempt. It now became necessary to push on with as much haste as possible, on account of the state of their provisions; for what with the loss sustained in fording the river, and in consumption, they were obliged to adopt an allowance.

On the 29th, they departed, at early dawn, in order to take advantage of the firmness of the snow, occasioned by the last night's frost. They ascended rapidly, and passed over the worst of the way, the horses sinking no deeper than their fetlocks. They first passed over a narrow ridge, and then a succession of small cones, until they reached the summit.

[1] This is an error and should read 121° 25′ W. as Naches Pass is known to be 121° 21′ and Lieutenant Johnson's "Little Prairie" was a little west of the Pass.

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Mount Rainier, from the top, bore south-southwest, apparently not more than ten miles distant. A profile of the mountain indicates that it has a terminal crater, as well as some on its flanks. The barometer stood at 24·950 in.: five thousand and ninety-two feet. There was another, to the north-northeast, covered with snow, and one to the west appeared about two hundred feet higher than the place where the observations were taken. This latter had suffered from fire in the same way as La Tête, and showed only a few patches of snow. To the eastward, a range of inferior height, running north and south, was in view, without snow.

On the western ascent of this mountain, the pines were scrubby; but at the summit, which was a plain, about a mile in length by half a mile wide, they were straight and towering, about eighty feet in height, without any limbs or foliage, except at the top. The distance travelled over the top was about five miles. On descending the east side, the snow was much deeper and softer, but the horses managed to get along well, and without accident.

Lieutenant Johnson, in following the party, missed the trail, and lost his way for three or four hours. On discovering the camp of those who had gone before, on the opposite side of a stream, he attempted to cross it on a log, in doing which his foot slipped, and he was precipitated into the water. Although his first thought was to save the chronometer from accident, it was too late, for the watch had stopped; it was not, however, so far injured as not to be set a-going, and it continued to go during the remainder of the journey: the only use I have been able to make of his subsequent observations, was to obtain the relative meridian distances between the points visited, without the absolute longitude. It is needless to say, that I placed little or no dependence on them, in constructing the map.

Although the horses had, with one or two exceptions, reached the eastern side of the mountain, yet they,

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together with the Indians, were very much exhausted. The time had now come when the Indians, according to agreement, were to be paid off, and they had done much more than they agreed to do, having crossed the mountain twice.

Finding the necessity of retaining all the blankets that had been brought with them, in order to buy horses, Lieutenant Johnson proposed to the Indians to receive an order on Nisqually, in lieu of the immediate delivery of the blankets. This they readily assented to, and also willingly gave up those that had already been paid them, on receiving a similar order, — thus showing a spirit of accommodation highly praiseworthy. Only two of them returned to Nisqually, to whom were entrusted the botanical specimens, and the care of the horses left upon the road.

The banks of the small streams on the eastern side of the mountain were bordered with the greatest variety of trees and shrubs, consisting of poplars, buckthorn fifty feet high, dogwood thirty to forty feet high, several species of willow, alder, two species of maple, and occasionally a yew. The undergrowth was composed of Hazel, Vaccinium, Gaultheria, and a prickly species of Aralia. The herbaceous shrubs were Goodyera, Neottia, Viola, Claytonia, Corallorrhiza. The latter, however, were not in flower.

The party on foot, after leaving the Little Prairie about half a mile, crossed the northern branch of the Smalocho,[1] which was found much swollen and very rapid. Two trees were cut down to form a bridge. After this, the walking through the forest became smooth and firm, and they passed on at a rapid pace. The Indians, although loaded with ninety pounds of baggage, kept up with the rest. At nightfall they encamped at the margin of the snow.

On lighting their fires, they accidentally set fire to the moss-covered trees, and in a few moments all around

[1] Greenwater branch of White River.

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them was a blazing mass of flame, which compelled them to change their quarters farther to windward. They had made eighteen miles. But few plants were found, the season being too early for collecting at so high an elevation. The ground was covered with spruce-twigs, which had apparently been broken off by the weight of the snow. The summit was passed through an open space about twenty acres in extent. This glade was surrounded with a dense forest of spruce trees. There was no danger in walking except near the young trees, which had been bent down by the snow, but on passing these they often broke through, and experienced much difficulty in extricating themselves, particularly the poor Indians, with their heavy burdens. The breadth of snow passed over was about eight miles. At three o'clock they reached the Spipen [1] River, where they encamped: this camp was found to be two thousand five hundred and forty-one feet above the level of the sea. The vegetation appeared to our botanical gentlemen farther advanced on the east side than on the west, at the same height; the Pulmonarias and several small annuals were more forward. There were only a few pine trees, and those small, seen on the west side of the ridge; and on the east side, there was a species of larch, the hackmatack of the country. While they remained at this camp, they found a Pyrola, and some new ferns.

The country about the Spipen [1] is mountainous and woody, with a narrow strip of meadow-land along its banks. Mr. Waldron had, on arriving at the camp, sent Lachemere, one of the Indians, down the river to an Indian chief, in order to procure horses. Those that remained after providing for the baggage, were consequently assigned each to two or three individuals to ride and tye on their route.

On the 30th, they proceeded down the Spipen, making a journey of eighteen miles, and passed another branch

[1] Naches River.

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of the river, the junction of which augmented its size very considerably. Its banks, too, became perpendicular and rocky, with a current flowing between them at the rate of six or seven miles an hour. After the junction, the stream was about one hundred feet broad, and its course was east-southeast.

The vegetation on the east side of the mountains was decidedly more advanced than that to the west, and several very interesting species of plants were met with by the botanists, on the banks of the streams: among them were Pæonia brownii, Cypripedium oregonium, Pentstemon, Ipomopsis elegans, and several Compositæ, and a very handsome flowering shrub, Purshia tridentata.

On the 31st, they continued their route over a rough country, in some places almost impassable for a horse from its steepness, and in others so marshy as to require much caution to prevent being mired.

During the morning, they met two Indians, who informed them that the chief of the Yakima tribe was a short distance in advance, waiting to meet them, and that he had several horses. At noon they reached a small prairie on the banks of the river, where old Tidias, the chief, was seen seated in state to receive Lieutenant Johnson; but this ceremony was unavoidably broken in upon by the necessity of getting the meridian observations. The chief, however, advanced towards him with every mark of friendship, giving the party a hearty welcome. In person he was tall, straight, and thin, a little bald, with long black hair hanging down his back, carefully tied with a worsted rag. He was grave, but dignified and graceful. When they had been seated, and after smoking a couple of pipes in silence, he intimated that he was ready for a talk, which then followed, relative to the rivers and face of the country; but little information was obtained that could be depended upon.

This tribe subsist chiefly upon salmon and the cam-

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mass-root: game is very scarce, and the beaver have all disappeared. The cammass-root is pounded and made into a sort of cake, which is not unpleasant, having a sweetish taste, but it is very dry, although some of the party took a fancy to it.

Tidias had with him an old man almost blind, who claimed much respect, and two young men, whose dress of buckskin, profusely ornamented with beads, was much admired by the party. During the talk, the old chief expressed himself delighted to see the white men, and spoke of his own importance, his immense territory, etc., in a style of boasting, to which the Indians are very much addicted. He said that he was desirous of affording all the accommodation he could to the party. But although he had eight or ten fine horses with him, he would not agree to part with them, as they were all his favourites. He was presented with a variety of articles, in return for which he gave the party a few dried salmon.

Towards evening, old Tidias took leave of them, saying that it was not proper for an Indian to encamp in the same place with a white man, and with a promise that he would have horses by ten o'clock the next day; but he had a game to play by procrastinating, in which he thoroughly succeeded.

In the morning they reached the Indian camp below, but no horses had arrived. It was far, they said, to Tidias's house; a man could not go thither and return in the same day; no horses or salmon could be brought; no one could be permitted to go. Lieutenant Johnson was then told that the road he had to follow was a "hungry" road. At last the Indian was induced by high offers to exchange good horses for a great number of bad ones, and finally consented to part with two more. On quitting him they became thoroughly aware that all the difficulties were owing, not to any indisposition to sell, but were created for the purpose of inducing high prices to be given.

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The party now branched off at right angles to their former route, Lieutenant Johnson heartily sick and tired of his friend Tidias and his people. Two more of the Indians here left them. The country they entered, after passing a ridge about six hundred feet high, was quite of a different aspect, forming long sloping hills, covered with a scanty growth of pines. Many dry beds of rivulets were passed, and the soil of the hills produced nothing but a long thin grass. There are, however, some small valleys where the growth of grass is luxuriant, the pines are larger, and the scenery assumed a park-like appearance.

From the summit of one of the hills, a sketch of Mount Rainier, and of the intervening range, was obtained.

On the top of the ridge they fell in with a number of Spipen Indians, who were engaged in digging the cammass and other roots. The latter were those of an umbelliferous plant, oblong, tuberous, and in taste resembling a parsnep. The process used to prepare them for bread, is to bake them in a well-heated oven of stones; when they are taken out they are dried, and then pounded between two stones till the mass becomes as fine as corn meal, when it is kneaded into cakes and dried in the sun. These roots are the principal vegetable food of the Indians throughout Middle Oregon. The women are frequently seen, to the number of twenty or thirty, with baskets suspended from the neck, and a pointed stick in their hand, digging these roots, and so intently engaged in the search for them, as to pay no attention whatever to a passer-by. When these roots are properly dried, they are stored away for the winter's consumption. This day they made only fifteen miles, in a northern direction.

On the 2d of June, they reached the Yakima, after having crossed a small stream. The Yakima was too deep for the horses to ford with their packs, and they now for the first time used their balsas of India-rubber

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cloth, which were found to answer the purpose of floating the loads across the stream.

This river is one hundred and fifty feet wide, and pursues an east-southeast course, with a velocity of more than four miles an hour. At this place were found twenty migrating Indians, who have their permanent residence on the banks lower down.

The chief, Kamaiyah, was the son-in-law of old Tidias, and one of the most handsome and perfectly-formed Indians they had met with. He was found to be gruff and surly in his manners, which was thought to be owing to his wish to appear dignified. These Indians were living in temporary huts, consisting of mats spread on poles. Among them was seen quite a pretty girl, dressed in a shirt and trousers, with moccasins of skin very much ornamented with fringe and beads. They had a number of fine horses, but could not be induced to part with any of them.

Lieutenant Johnson had now succeeded in purchasing venison and salmon, and the party again had full allowance.

On the 3d, they continued their route to the northward, over gradually rising ground, and Lieutenant Johnson having succeeded in purchasing three more horses, only three of the party were now without them, so that the riding and tye system was not quite so often resorted to as before. On this plain was seen a number of curlews, some grouse, and a large species of hare. They encamped again near the snow, and found their altitude greater than any yet reached, the barometer standing at 24·750 in.: five thousand two hundred and three feet. They had again reached the spruces and lost the pine, which was only found on the hill-sides and plains.

At 4 A.M. on the morning of the 4th of June, the thermometer stood at 28°. They on that day continued their route up the mountain and across its summit, which was here and there covered with patches

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of snow. I regret to record another accident to the instruments. The sergeant, to whom the barometer was intrusted by Lieutenant Johnson, in putting up the instrument this morning, carelessly broke it; and thus ended the barometrical experiments in the most interesting portion of the route.

It is difficult to account for the scarcity of snow on a much higher elevation than they had before reached, and under circumstances which would appear to have warranted a contrary expectation. Dr. Pickering was induced to believe that this change in the climate is owing to the open nature of the surrounding country; its being devoid of dense forests, with but a few scattered trees and no under-brush; and the vicinity to elevated plains, and the ridge being of a less broken character.

The early part of the day was cold, with showers of sleet. On the crest of the mountain they passed over swampy ground, with but a few patches of spruces: after passing which, they began to descend very regularly towards the Columbia, which they reached early in the afternoon, about three miles below the Pischous River.[1] The Columbia at this place is a rapid stream, but the scenery differs entirely from that of other rivers: its banks are altogether devoid of any fertile alluvial flats; destitute even of scattered trees; there is no freshness in the little vegetation on its borders; the sterile sands in fact reach to its very brink, and it is scarcely to be believed until its banks are reached that a mighty river is rolling its waters past these arid wastes.

[The record of the journey to Fort Colville is omitted, to be resumed when the party returning draws near the environs of Mount Rainier. The portion omitted extends from page 430 to 468 in the original publication.]

[1] Wenatchee River.

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The party now pursued the route up the river, and in two hours reached the Yakima, up whose valley they passed, encamping after making twenty-five miles. The country was rolling, and might be termed sandy and barren.

Mount St. Helen's,[1] with its snow-capped top, was seen at a great distance to the west.

On the 5th, they continued their route, and at midday were overtaken by an Indian, with a note informing them of the arrival of Mr. Drayton at Wallawalla with the brigade. This was quick travelling for news in Oregon; for so slow is it usually carried, that our party were the first to bring the news of the arrival and operations of the squadron in Oregon. This intelligence had not previously reached Wallawalla, although it is considered to be on the direct post-route to the interior, notwithstanding we had been in the country nearly two months. The news of the murder of Mr. Black, in New Caledonia, was nearly a year in reaching some points on the coast.

This was one of the warmest days they had experienced, and the thermometer under the shade of a canopy stood at 108°. At a short distance from the place where they stopped was a small hut, composed of a few branches and reeds, which was thought to be barely sufficient to contain a sheep; yet under it were four generations of human beings, all females, seated in a posture, which, to whites, would have been impracticable. They had just procured their subsistence for the day, and their meal consisted of the berries of the dogwood. The scene was not calculated to impress one very favourably with savage life. The oldest of these had the cartilage of the nose pierced, but the others had not; leading to the conclusion that the practice had been discontinued for some years in the nation, who still, however, retain the name.

The country exhibited little appearance of vegeta-

[1] Mount Adams. The two peaks were frequently confused in early writings.

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tion; the herbage was quite dried up, and from appearances was likely to continue so throughout the season. The prevailing vegetation consisted of bushes of wormwood, stinted in growth, and unyielding.

After making thirty-three miles, they encamped among loose sand, one hundred feet above the water of the river. Many rattlesnakes were found in this vicinity.

Owing to the quantities of musquitoes, combined with the fear of snakes, the party obtained little or no rest, and were all glad to mount their horses and proceed on their way.

In the early part of the day, they arrived at the junction of the Spipen with the Yakima: previous to this they crossed another branch, coming in from the southwest; the waters of the latter were very turbid, of a dark-brown colour, and it was conjectured that it had its source at or near Mount Rainier. Along its banks was seen a range of basaltic columns. The Yakima was crossed during the day in canoes, the river not being yet fordable.

The country, which had for some days exhibited the appearance of the Tillandsia districts of Peru, had now begun to acquire a tinge of green, and some scattered pine trees had become visible. Some small oaks were passed, which appeared of a local character. This night they again had a number of rattlesnakes in their camp.

On the 8th, the valley had narrowed, and the banks becoming more perpendicular, they had a great many difficulties to encounter. They stopped at the camp of old Tidias, whom, it will be recollected, they had encountered after crossing the mountains, and from whom they obtained some horses. They soon afterwards arrived at the path where they had turned off to the north. The river had fallen very much during their absence, and there was a marked difference in the season, the vegetation being much more backward than

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in the parts they had recently visited. The berries were just beginning to ripen, while in the plains, not twenty miles distant, they were already over. Old Tidias determined to accompany them to Nisqually, taking with him his son, and lending them several horses. The Spipen, up which they passed, was now hemmed in by mountain ridges, occasionally leaving small portions of level ground. They encamped at the place they had occupied on the 30th of May.

The vegetation, since they had passed this place, had so much advanced that they had difficulty in recognising it again. The wet prairies were overgrown with rank grass, from one to two feet in height. After a short rest at the foot of the mountain, they began its ascent, and reached the crest of the ridge in about three hours. On every side they found a low growth of shrubs, which they had not suspected when it was covered with snow, and causing the summit to differ essentially from the broad ridge they had crossed between the Yakima and Pischous rivers. They encamped for the night on the edge of a wet prairie, which afforded pasturage for their horses.

The next day they passed through several similar prairies, and descended the western slope of the mountain, where they found more patches of snow than on the east side. This was just the reverse of what they had found on their previous passage; the season, too, was evidently much less advanced. This circumstance was supposed to be owing to the denser forest on the west, as well as the absence of elevated plains.

They encamped the same night at the little prairie before spoken of, at the foot of the western slope. Before reaching it, they met a party of men and women carrying a sick chief over the mountain, who was evidently dying. It was affecting to see him stretching forth his hand to them as they passed, as if desiring to be friends with all before he died. He died the same night.

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The two next days it rained almost constantly, but they found the road much less difficult to travel than before, and the streams were fordable, which enabled them to make more rapid progress.

On the 13th, they passed the Smalocho, and on the 15th reached Nisqually, all well; having performed a journey of about one thousand miles without any material accident, except those that have been related as having occurred to the instruments. They traversed a route which white men had never before taken, thus enabling us to become acquainted with a portion of the country about which all had before been conjecture. They had also made a large addition to our collection of plants.

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IV. TACOMA AND THE INDIAN LEGEND OF HAMITCHOU

By THEODORE WINTHROP

THEODORE WINTHROP was a descendant of the famous Governor John Winthrop, of Massachusetts. He was born at New Haven, Connecticut, on September 22, 1828, and lost his life early in the Civil War near Great Bethel, Virginia, on June 10, 1861. His death was deeply mourned as of one who had given great promise of success in the field of literature.

His book, *The Canoe and the Saddle*, has appeared in many editions. It tells of his visit to Puget Sound and across the Cascade Mountains in 1853. In that volume he declares that the Indians called the mountain, Tacoma. So far as is known to the editor, that is the first place that that name for the mountain appeared in print.

In addition to this interesting fact, the book is a charming piece of literature, and will endure as one of the classics on the Pacific Northwest. The portions here reproduced relate to the mountain. They are taken from an early edition of the book published by the John W. Lovell Company of New York. The edition carries no date, but the copyright notice is by Ticknor and Fields, 1862. The parts used are from pages 43–45, and 123–176.

The author's niece, Elizabeth Winthrop Johnson, of Pasadena, California, kindly furnished a photograph of Rowse's portrait of her famous uncle.

The large and beautiful glacier sweeping from the northeast summit past the western slope of Steamboat Prow now bears the name of Winthrop Glacier.

We had rounded a point, and opened Puyallop Bay, a breadth of sheltered calmness, when I, lifting sleepy eyelids for a dreamy stare about, was suddenly aware of a vast white shadow in the water. What cloud, piled massive on the horizon, could cast an image so sharp in outline, so full of vigorous detail of surface?

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THEODORE WINTHROP.
From the Rowse crayon portrait.

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No cloud, as my stare, no longer dreamy, presently discovered, — no cloud, but a cloud compeller. It was a giant mountain dome of snow, swelling and seeming to fill the aërial spheres as its image displaced the blue deeps of tranquil water. The smoky haze of an Oregon August hid all the length of its lesser ridges, and left this mighty summit based upon uplifting dimness. Only its splendid snows were visible, high in the unearthly regions of clear blue noonday sky. The shore line drew a cincture of pines across the broad base, where it faded unreal into the mist. The same dark girth separated the peak from its reflection, over which my canoe was now pressing, and sending wavering swells to shatter the beautiful vision before it.

Kingly and alone stood this majesty, without any visible comrade or consort, though far to the north and the south its brethren and sisters dominated their realms, each in isolated sovereignty, rising above the pine-darkened sierra of the Cascade Mountains, — above the stern chasm where the Columbia, Achilles of rivers, sweeps, short-lived and jubilant, to the sea, — above the lovely vales of the Willamette and Umpqua. Of all the peaks from California to Frazer's River, this one before me was royalest. Mount Regnier Christians have dubbed it, in stupid nomenclature perpetuating the name of somebody or nobody. More melodiously the siwashes call it Tacoma, — a generic term also applied to all snow peaks. Whatever keen crests and crags there may be in its rock anatomy of basalt, snow covers softly with its bends and sweeping curves. Tacoma, under its ermine, is a crushed volcanic dome, or an ancient volcano fallen in, and perhaps as yet not wholly lifeless. The domes of snow are stateliest. There may be more of feminine beauty in the cones, and more of masculine force and hardihood in the rough pyramids, but the great domes are calmer and more divine, and, even if they have failed to attain absolute dignified grace of finish, and

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are riven and broken down, they still demand our sympathy for giant power, if only partially victor. Each form — the dome, the cone, and the pyramid — has its type among the great snow peaks of the Cascades.

[Chapter VII, beginning at page 123 of the original publication, is entitled "Tacoma."]

Up and down go the fortunes of men, now benignant, now malignant. *Ante meridiem* of our lives, we are rising characters. Our full noon comes, and we are borne with plaudits on the shoulders of a grateful populace. *Post meridiem*, we are ostracized, if not more rudely mobbed. At twilight, we are perhaps recalled, and set on the throne of Nestor.

Such slow changes in esteem are for men of some import and of settled character. Loolowcan suffered under a more rapidly fluctuating public opinion. At the camp of the road-makers, he had passed through a period of neglect, — almost of ignominy. My hosts had prejudices against redskins; they treated the son of Owhhigh with no consideration; and he became depressed and slinking in manner under the influence of their ostracism. No sooner had we disappeared from the range of Boston eyes than Loolowcan resumed his leadership and his control. I was very secondary now, and followed him humbly enough up the heights we had reached. Here were all the old difficulties increased, because they were no longer met on a level. We were to climb the main ridge, — the mountain of La Tête, — abandoning the valley, assaulting the summits. And here, as Owhhigh had prophesied in his harangue at Nisqually, the horse's mane must be firmly grasped by the climber. Poor, panting, weary nags! may it be true, the promise of Loolowcan, that not far away is abundant fodder! But where can aught, save firs with ostrich digestion, grow on these rough, forest-clad shoulders?

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So I clambered on till near noon.

I had been following thus for many hours the blind path, harsh, darksome, and utterly lonely, urging on with no outlook, encountering no landmark, — at last, as I stormed a ragged crest, gaining a height that overtopped the firs, and, halting there for panting moments, glanced to see if I had achieved mastery as well as position, — as I looked somewhat wearily and drearily across the solemn surges of forest, suddenly above their sombre green appeared Tacoma. Large and neighbor it stood, so near that every jewel of its snow-fields seemed to send me a separate ray; yet not so near but that I could with one look take in its whole image, from clear-cut edge to edge.

All around it the dark evergreens rose like a ruff; above them the mountain splendors swelled statelier for the contrast. Sunlight of noon was so refulgent upon the crown, and lay so thick and dazzling in nooks and chasms, that the eye sought repose of gentler lights, and found it in shadowed nooks and clefts, where, sunlight entering not, delicate mist, an emanation from the blue sky, had fallen, and lay sheltered and tremulous, a mild substitute for the stronger glory. The blue haze so wavered and trembled into sunlight, and sunbeams shot glimmering over snowy brinks so like a constant avalanche, that I might doubt whether this movement and waver and glimmer, this blending of mist with noontide flame, were not a drifting smoke and cloud of yellow sulphurous vapor floating over some slowly chilling crater far down in the red crevices.

But if the giant fires had ever burned under that cold summit, they had long since gone out. The dome that swelled up passionately had crûsted over and then fallen in upon itself, not vigorous enough with internal life to bear up in smooth proportion. Where it broke into ruin was no doubt a desolate waste, stern, craggy, and riven, but such drear results of Titanic convulsion the gentle snows hid from view.

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No foot of man had ever trampled those pure snows. It was a virginal mountain, distant from the possibility of human approach and human inquisitiveness as a marble goddess is from human love.

Yet there was nothing unsympathetic in its isolation, or despotic in its distant majesty. But this serene loftiness was no home for any deity of those that men create. Only the thought of eternal peace arose from this heaven-upbearing monument like incense, and, overflowing, filled the world with deep and holy calm.

Wherever the mountain turned its cheek toward the sun, many fair and smiling dimples appeared, and along soft curves of snow, lines of shadow drew tracery fair as the blue veins on a child's temple. Without the infinite sweetness and charm of this kindly changefulness of form and color, there might have been oppressive awe in the presence of this transcendent glory against the solemn blue of noon. Grace played over the surface of majesty, as a drift of rose-leaves wavers in the air before a summer shower, or as a wreath of rosy mist flits before the grandeur of a storm. Loveliness was sprinkled like a boon of blossoms upon sublimity.

Our lives forever demand and need visual images that can be symbols to us of the grandeur or the sweetness of repose. There are some faces that arise dreamy in our memories, and look us into calmness in our frantic moods. Fair and happy is a life that need not call upon its vague memorial dreams for such attuning influence, but can turn to a present reality, and ask tranquillity at the shrine of a household goddess. The noble works of nature, and mountains most of all,

> "have power to make
> Our noisy years seem moments in the being
> Of the eternal silence."

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And, studying the light and the majesty of Tacoma, there passed from it and entered into my being, to dwell there evermore by the side of many such, a thought and an image of solemn beauty, which I could thenceforth evoke whenever in the world I must have peace or die. For such emotion years of pilgrimage were worthily spent. If mortal can gain the thoughts of immortality, is not his earthly destiny achieved? For, when we have so studied the visible poem, and so fixed it deep in the very substance of our minds, there is forever with us not merely a perpetual possession of delight, but a watchful monitor that will not let our thoughts be long unfit for the pure companionship of beauty. For whenever a man is false to the light that is in him, and accepts meaner joys, or chooses the easy indulgence that meaner passions give, then every fair landscape in all his horizon dims, and all its grandeurs fade and dwindle away, the glory vanishes, and he looks, like one lost, upon his world, late so lovely and sinless.

While I was studying Tacoma, and learning its fine lesson, it in turn might contemplate its own image far away on the waters of Whulge, where streams from its own snows, gushing seaward to buffet in the boundless deep, might rejoice in a last look at their parent ere they swept out of Puyallop Bay. Other large privilege of view it had. It could see what I could not, — Tacoma the Less, Mt. Adams, meritorious but clumsy; it could reflect sunbeams gracefully across a breadth of forest to St. Helen's, the vestal virgin, who still kept her flame kindled, and proved her watchfulness ever and anon. Continuing its panoramic studies, Tacoma could trace the chasm of the Columbia by silver circles here and there, — could see every peak, chimney, or unopened vent, from Kulshan to Shasta Butte. The Blue Mountains eastward were within its scope, and westward the faint-blue levels of the Pacific. Another region, worthy of any

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mountain's beholding, Tacoma sees, somewhat vague and dim in distance: it sees the sweet Arcadian valley of the Willamette, charming with meadow, park, and grove. In no older world where men have, in all their happiest moods, recreated themselves for generations in taming earth to orderly beauty, have they achieved a fairer garden than Nature's simple labor of love has made there, giving to rough pioneers the blessings and the possible education of refined and finished landscape, in the presence of landscape strong, savage, and majestic.

All this Tacoma beholds, as I can but briefly hint; and as one who is a seer himself becomes a tower of light and illumination to the world, so Tacoma, so every brother seer of his among the lofty snow-peaks, stands to educate, by his inevitable presence, every dweller thereabouts. Our race has never yet come into contact with great mountains as companions of daily life, nor felt that daily development of the finer and more comprehensive senses which these signal facts of nature compel. That is an influence of the future. The Oregon people, in a climate where being is bliss, — where every breath is a draught of vivid life, — these Oregon people, carrying to a new and grander New England of the West a fuller growth of the American Idea, under whose teaching the man of lowest ambitions must still have some little indestructible respect for himself, and the brute of most tyrannical aspirations some little respect for others; carrying the civilization of history where it will not suffer by the example of Europe, — with such material, that Western society, when it crystallizes, will elaborate new systems of thought and life. It is unphilosophical to suppose that a strong race, developing under the best, largest, and calmest conditions of nature, will not achieve a destiny.

Up to Tacoma, or into some such solitude of nature, imaginative men must go, as Moses went up to Sinai,

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that the divine afflatus may stir within them. The siwashes appreciate, according to their capacity, the inspiration of lonely grandeur, and go upon the mountains, starving and alone, that they may become seers, enchanters, magicians, diviners, — what in conventional lingo is called "big medicine." For though the Indians here have not peopled these thrones of their world with the creatures of an anthropomorphic mythology, they yet deem them the abode of Tamanoüs. Tamanoüs is a vague and half-personified type of the unknown, of the mysterious forces of nature; and there is also an indefinite multitude of undefined emanations, each one a tamanoüs with a small t, which are busy and impish in complicating existence, or equally active and spritely in unravelling it. Each Indian of this region patronizes his own personal tamanoüs, as men of the more eastern tribes keep a private manitto, and as Socrates kept a daimôn. To supply this want, Tamanoüs with a big T undergoes an avatar, and incarnates himself into a salmon, a beaver, a clam, or into some inanimate object, such as a canoe, a paddle, a fir-tree, a flint, or into some elemental essence, as fire, water, sun, mist; and tamanoüs thus individualized becomes the "guide, philosopher, and friend" of every siwash, conscious that otherwise he might stray and be lost in the unknown realms of Tamanoüs.

Hamitchou, a frowzy ancient of the Squallyamish, told to Dr. Tolmie and me, at Nisqually, a legend of Tamanoüs and Tacoma, which, being interpreted, runs as follows: —

Hamitchou's Legend

"Avarice, O Boston tyee," quoth Hamitchou, studying me with dusky eyes, "is a mighty passion. Now, be it known unto thee that we Indians anciently used not metals nor the money of you blanketeers. Our circulating medium was shells, — wampum you would

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name it. Of all wampum, the most precious is Hiaqua. Hiaqua comes from the far north. It is a small, perforated shell, not unlike a very opaque quill toothpick, tapering from the middle, and cut square at both ends. We string it in many strands, and hang it around the neck of one we love, — namely, each man his own neck. We also buy with it what our hearts desire. He who has most hiaqua is best and wisest and happiest of all the northern Haida and of all the people of Whulge. The mountain horsemen value it; and braves of the terrible Blackfeet have been known, in the good old days, to come over and offer a horse or a wife for a bunch of fifty hiaqua.

"Now, once upon a time there dwelt where this fort of Nisqually now stands a wise old man of the Squallyamish. He was a great fisherman and a great hunter; and the wiser he grew, much the wiser he thought himself. When he had grown very wise, he used to stay apart from every other siwash. Companionable salmon-boilings round a common pot had no charms for him. 'Feasting was wasteful,' he said, 'and revellers would come to want.' And when they verified his prophecy, and were full of hunger and empty of salmon, he came out of his hermitage, and had salmon to sell.

"Hiaqua was the pay he always demanded; and as he was a very wise old man, and knew all the tideways of Whulge, and all the enticing ripples and placid spots of repose in every river where fish might dash or delay, he was sure to have salmon when others wanted, and thus bagged largely of its precious equivalent, hiaqua.

"Not only a mighty fisher was the sage, but a mighty hunter, and elk, the greatest animal of the woods, was the game he loved. Well had he studied every trail where elk leave the print of their hoofs, and where, tossing their heads, they bend the tender twigs. Well had he searched through the broad forest, and

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found the long-haired prairies where elk feed luxuriously; and there, from behind palisade fir-trees, he had launched the fatal arrow. Sometimes, also, he lay beside a pool of sweetest water, revealed to him by gemmy reflections of sunshine gleaming through the woods, until at noon the elk came down, to find death awaiting him as he stooped and drank. Or beside the same fountain the old man watched at night, drowsily starting at every crackling branch, until, when the moon was high, and her illumination declared the pearly water, elk dashed forth incautious into the glade, and met their midnight destiny.

"Elk-meat, too, he sold to his tribe. This brought him pelf, but, alas for his greed, the pelf came slowly. Waters and woods were rich in game. All the Squallyamish were hunters and fishers, though none so skilled as he. They were rarely in absolute want, and, when they came to him for supplies, they were far too poor in hiaqua.

"So the old man thought deeply, and communed with his wisdom, and, while he waited for fish or beast, he took advice within himself from his demon, — he talked with Tamanoüs. And always the question was, 'How may I put hiaqua in my purse?'

"Tamanoüs never revealed to him that far to the north, beyond the waters of Whulge, are tribes with their under lip pierced with a fishbone, among whom hiaqua is plenty as salmonberries are in the woods what time in mid-summer salmon fin it along the reaches of Whulge.

"But the more Tamanoüs did not reveal to him these mysteries of nature, the more he kept dreamily prying into his own mind, endeavoring to devise some scheme by which he might discover a treasure-trove of the beloved shell. His life seemed wasted in the patient, frugal industry, which only brought slow, meagre gains. He wanted the splendid elation of vast wealth and the excitement of sudden wealth.

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His own peculiar tamanoüs was the elk. Elk was also his totem, the cognizance of his freemasonry with those of his own family, and their family friends in other tribes. Elk, therefore, were every way identified with his life; and he hunted them farther and farther up through the forests on the flanks of Tacoma, hoping that some day his tamanoüs would speak in the dying groan of one of them, and gasp out the secret of the mines of hiaqua, his heart's desire.

"Tacoma was so white and glittering, that it seemed to stare at him very terribly and mockingly, and to know his shameful avarice, and how it led him to take from starving women their cherished lip and nose jewels of hiaqua, and to give them in return only tough scraps of dried elk-meat and salmon. When men are shabby, mean, and grasping, they feel reproached for their grovelling lives by the unearthliness of nature's beautiful objects, and they hate flowers, and sunsets, mountains, and the quiet stars of heaven.

"Nevertheless," continued Hamitchou, "this wise old fool of my legend went on stalking elk along the sides of Tacoma, ever dreaming of wealth. And at last, as he was hunting near the snows one day, one very clear and beautiful day of late summer, when sunlight was magically disclosing far distances, and making all nature supernaturally visible and proximate, Tamanoüs began to work in the soul of the miser.

"'Are you brave,' whispered Tamanoüs in the strange, ringing, dull, silent thunder-tones of a demon voice. 'Dare you go to the caves where my treasures are hid?'

"'I dare,' said the miser.

"He did not know that his lips had syllabled a reply. He did not even hear his own words. But all the place had become suddenly vocal with echoes. The great rock against which he leaned crashed forth, 'I dare.' Then all along through the forest, dashing from tree to tree and lost at last among the murmur-

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ing of breeze-shaken leaves, went careering his answer, taken up and repeated scornfully, 'I dare.' And after a silence, while the daring one trembled and would gladly have ventured to shout, for the companionship of his own voice, there came across from the vast snow wall of Tacoma a tone like the muffled, threatening plunge of an avalanche into a chasm, 'I dare.'

"'You dare,' said Tamanoüs, enveloping him with a dread sense of an unseen, supernatural presence; 'you pray for wealth of hiaqua. Listen!'

"This injunction was hardly needed; the miser was listening with dull eyes kindled and starting. He was listening with every rusty hair separating from its unkempt mattedness, and outstanding upright, a caricature of an aureole.

"'Listen,' said Tamanoüs, in the noonday hush. And then Tamanoüs vouchsafed at last the great secret of the hiaqua mines, while in terror near to death the miser heard, and every word of guidance toward the hidden treasure of the mountains seared itself into his soul ineffaceably.

"Silence came again more terrible now than the voice of Tamanoüs, — silence under the shadow of the great cliff, — silence deepening down the forest vistas, — silence filling the void up to the snows of Tacoma. All life and motion seemed paralyzed. At last Skai-ki, the Blue-Jay, the wise bird, foe to magic, sang cheerily overhead. Her song seemed to refresh again the honest laws of nature. The buzz of life stirred everywhere again, and the inspired miser rose and hastened home to prepare for his work.

"When Tamanoüs has put a great thought in a man's brain, has whispered him a great discovery within his power, or hinted at a great crime, that spiteful demon does not likewise suggest the means of accomplishment.

"The miser, therefore, must call upon his own skill to devise proper tools, and upon his own judgment

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to fix upon the most fitting time for carrying out his quest. Sending his squaw out to the kamas prairie, under pretence that now was the season for her to gather their winter store of that sickish-sweet esculent root, and that she might not have her squaw's curiosity aroused by seeing him at strange work, he began his preparations. He took a pair of enormous elk-horns, and fashioned from each horn a two-pronged pick or spade, by removing all the antlers except the two topmost. He packed a good supply of kippered salmon, and filled his pouch with kinni kinnick for smoking in his black stone pipe. With his bow and arrows and his two elk-horn picks wrapped in buckskin hung at his back, he started just before sunset, as if for a long hunt. His old, faithful, maltreated, blanketless, vermilionless squaw, returning with baskets full of kamas, saw him disappearing moodily down the trail.

"All that night, all the day following, he moved on noiselessly by paths he knew. He hastened on, unnoticing outward objects, as one with a controlling purpose hastens. Elk and deer, bounding through the trees, passed him, but he tarried not. At night he camped just below the snows of Tacoma. He was weary, weary, and chill night-airs blowing down from the summit almost froze him. He dared not take his fire-sticks, and, placing one perpendicular upon a little hollow on the flat side of the other, twirl the upright stick rapidly between his palms until the charred spot kindled and lighted his 'tipsoo,' his dry, tindery wool of inner bark. A fire, gleaming high upon the mountain-side, might be a beacon to draw thither any night-wandering savage to watch in ambush, and learn the path toward the mines of hiaqua. So he drowsed chilly and fireless, awakened often by dread sounds of crashing and rumbling among the chasms of Tacoma. He desponded bitterly, almost ready to abandon his quest, almost doubting whether he had in truth received a revelation, whether his interview

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with Tamanoüs had not been a dream, and finally whether all the hiaqua in the world was worth this toil and anxiety. Fortunate is the sage who at such a point turns back and buys his experience without worse befalling him.

"Past midnight he suddenly was startled from his drowse, and sat bolt upright in terror. A light. Was there another searcher in the forest, and a bolder than he? That flame just glimmering over the tree-tops, was it a camp-fire of friend or foe? Had Tamanoüs been revealing to another the great secret? No, smiled the miser, his eyes fairly open, and discovering that the new light was the moon. He had been waiting for her illumination of paths heretofore untrodden by mortal. She did not show her full, round jolly face, but turned it askance as if she hardly liked to be implicated in this night's transaction.

"However, it was light he wanted, not sympathy, and he started up at once to climb over the dim snows. The surface was packed by the night's frost, and his moccasins gave him firm hold; yet he travelled but slowly, and could not always save himself from a *glissade* backwards, and a bruise upon some projecting knob or crag. Sometimes, upright fronts of ice diverted him for long circuits, or a broken wall of cold cliff arose, which he must surmount painfully. Once or twice he stuck fast in a crevice, and hardly drew himself out by placing his bundle of picks across the crack. As he plodded and floundered thus deviously and toilsomely upward, at last the wasted moon gan pale overhead, and under foot the snow grew rosy with coming dawn. The dim world about the mountain's base displayed something of its vast detail. He could see, more positively than by moonlight, the far-reaching arteries of mist marking the organism of Whulge beneath; and what had been but a black chaos now revealed itself into the Alpine forest whence he had come.

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"But he troubled himself little with staring about; up he looked, for the summit was at hand. To win that summit was wellnigh the attainment of his hopes, if Tamanoüs were true; and that, with the flush of morning ardor upon him, he could not doubt. There, in a spot Tamanoüs had revealed to him, was hiaqua, — hiaqua that should make him the richest and greatest of all the Squallyamish.

"The chill before sunrise was upon him as he reached the last curve of the dome. Sunrise and he struck the summit together. Together sunrise and he looked over the glacis. They saw within a great hollow all covered with the whitest of snow, save at the centre, where a black lake lay deep in a well of purple rock.

"At the eastern end of this lake was a small, irregular plain of snow, marked by three stones like monuments. Towards these the miser sprang rapidly, with full sunshine streaming after him over the snows.

"The first monument he examined with keen looks. It was tall as a giant man, and its top was fashioned into the grotesque likeness of a salmon's head. He turned from this to inspect the second. It was of similar height, but bore at its apex an object in shape like the regular flame of a torch. As he approached, he presently discovered that this was an image of the kamas-bulb in stone. These two semblances of prime necessities of Indian life delayed him but an instant, and he hastened on to the third monument, which stood apart on a perfect level. The third stone was capped by something he almost feared to behold, lest it should prove other than his hopes. Every word of Tamanoüs had thus far proved veritable; but might there not be a bitter deceit at the last? The miser trembled.

"Yes, Tamanoüs was trustworthy. The third monument was as the old man anticipated. It was a stone elk's head, such as it appears in earliest summer, when the antlers are sprouting lustily under their rough jacket of velvet.

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"You remember, Boston tyee," continued Hamitchou, "that Elk was the old man's tamanoüs, the incarnation for him of the universal Tamanoüs. He therefore was right joyous at this good omen of protection; and his heart grew big and swollen with hope, as the black salmon-berry swells in a swamp in June. He threw down his 'ikta'; every impediment he laid down upon the snow; and, unwrapping his two picks of elk-horn, he took the stoutest, and began to dig in the frozen snow at the foot of the elk-head monument.

"No sooner had he struck the first blow than he heard behind him a sudden puff, such as a seal makes when it comes to the surface to breathe. Turning round much startled, he saw a huge otter just clambering up over the edge of the lake. The otter paused, and struck on the snow with his tail, whereupon another otter and another appeared, until, following their leader in slow and solemn file, were twelve other otters, marching toward the miser. The twelve approached, and drew up in a circle around him. Each was twice as large as any otter ever seen. Their chief was four times as large as the most gigantic otter ever seen in the regions of Whulge, and certainly was as great as a seal. When the twelve were arranged, their leader skipped to the top of the elk-head stone, and sat there between the horns. Then the whole thirteen gave a mighty puff in chorus.

"The hunter of hiaqua was for a moment abashed at his uninvited ring of spectators. But he had seen otter before, and bagged them. These he could not waste time to shoot, even if a phalanx so numerous were not formidable. Besides, they might be tamanoüs. He took to his pick and began digging stoutly.

"He soon made way in the snow, and came to solid rock beneath. At every thirteenth stroke of his pick, the fugelman otter tapped with his tail on the monument. Then the choir of lesser otters tapped together

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with theirs on the snow. This caudal action produced a dull, muffled sound, as if there were a vast hollow below.

"Digging with all his force, by and by the seeker for treasure began to tire, and laid down his elk-horn spade to wipe the sweat from his brow. Straightway the fugleman otter turned, and, swinging his tail, gave the weary man a mighty thump on the shoulder; and the whole band, imitating, turned, and, backing inward, smote him with centripetal tails, until he resumed his labors, much bruised.

"The rock lay first in plates, then in scales. These it was easy to remove. Presently, however, as the miser pried carelessly at a larger mass, he broke his elkhorn tool. Fugleman otter leaped down, and seizing the supplemental pick between his teeth, mouthed it over to the digger. Then the amphibious monster took in the same manner the broken pick, and bore it round the circle of his suite, who inspected it gravely with puffs.

"These strange, magical proceedings disconcerted and somewhat baffled the miser; but he plucked up heart, for the prize was priceless, and worked on more cautiously with his second pick. At last its blows and the regular thumps of the otter's tails called forth a sound hollower and hollower. His circle of spectators narrowed so that he could feel their panting breath as they bent curiously over the little pit he had dug.

"The crisis was evidently at hand.

"He lifted each scale of rock more delicately. Finally he raised a scale so thin that it cracked into flakes as he turned it over. Beneath was a large square cavity.

"It was filled to the brim with hiaqua.

"He was a millionnaire.

"The otters recognized him as the favorite of Tamanoüs, and retired to a respectful distance.

"For some moments he gazed on his treasure, tak-

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ing thought of his future proud grandeur among the dwellers by Whulge. He plunged his arm deep as he could go; there was still nothing but the precious shells. He smiled to himself in triumph; he had wrung the secret from Tamanoüs. Then, as he withdrew his arm, the rattle of the hiaqua recalled him to the present. He saw that noon was long past, and he must proceed to reduce his property to possession.

"The hiaqua was strung upon long, stout sinews of elk, in bunches of fifty shells on each side. Four of these he wound about his waist; three he hung across each shoulder; five he took in each hand; — twenty strings of pure white hiaqua, every shell large, smooth, unbroken, beautiful. He could carry no more; hardly even with this could he stagger along. He put down his burden for a moment, while he covered up the seemingly untouched wealth of the deposit carefully with the scale stones, and brushed snow over the whole.

"The miser never dreamed of gratitude, never thought to hang a string from the buried treasure about the salmon and kamas tamanoüs stones, and two strings around the elk's head; no, all must be his own, all he could carry now, and the rest for the future.

"He turned, and began his climb toward the crater's edge. At once the otters, with a mighty puff in concert, took up their line of procession, and, plunging into the black lake, began to beat the water with their tails.

"The miser could hear the sound of splashing water as he struggled upward through the snow, now melted and yielding. It was a long hour of harsh toil and much backsliding before he reached the rim, and turned to take one more view of this valley of good fortune.

"As he looked, a thick mist began to rise from the lake centre, where the otters were splashing. Under the mist grew a cylinder of black cloud, utterly hiding the water.

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"Terrible are storms in the mountains; but in this looming mass was a terror more dread than any hurricane of ruin ever bore within its wild vortexes. Tamanoüs was in that black cylinder, and as it strode forward, chasing in the very path of the miser, he shuddered, for his wealth and his life were in danger.

"However, it might be but a common storm. Sunlight was bright as ever overhead in heaven, and all the lovely world below lay dreamily fair, in that afternoon of summer, at the feet of the rich man, who now was hastening to be its king. He stepped from the crater edge and began his descent.

"Instantly the storm overtook him. He was thrown down by its first assault, flung over a rough bank of iciness, and lay at the foot torn and bleeding, but clinging still to his precious burden. Each hand still held its five strings of hiaqua. In each hand he bore a nation's ransom. He staggered to his feet against the blast. Utter night was around him, — night as if daylight had forever perished, had never come into being from chaos. The roaring of the storm had also deafened and bewildered him with its wild uproar.

"Present in every crash and thunder of the gale was a growing undertone, which the miser well knew to be the voice of Tamanoüs. A deadly shuddering shook him. Heretofore that potent Unseen had been his friend and guide; there had been awe, but no terror, in his words. Now the voice of Tamanoüs was inarticulate, but the miser could divine in that sound an unspeakable threat of wrath and vengeance. Floating upon this undertone were sharper tamanoüs voices, shouting and screaming always sneeringly, 'Ha, ha, hiaqua! — ha, ha, ha!'

"Whenever the miser essayed to move and continue his descent, a whirlwind caught him, and with much ado tossed him hither and thither, leaving him at last flung and imprisoned in a pinching crevice, or

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buried to the eyes in a snowdrift, or bedded upside down on a shaggy boulder, or gnawed by lacerating lava jaws. Sharp torture the old man was encountering, but he held fast to his hiaqua.

"The blackness grew ever deeper and more crowded with perdition; the din more impish, demoniac, and devilish; the laughter more appalling; and the miser more and more exhausted with vain buffeting. He determined to propitate exasperated Tamanoüs with a sacrifice. He threw into the black cylinder storm his left-handful, five strings of precious hiaqua."

"Somewhat long-winded is thy legend, Hamitchou, Great Medicine-Man of the Squallyamish," quoth I. "Why didn't the old fool drop his wampum, — shell out, as one might say, — and make tracks?"

"Well, well!" continued Hamitchou; "when the miser had thrown away his first handful of hiaqua, there was a momentary lull in elemental war, and he heard the otters puffing around him invisible. Then the storm renewed, blacker, louder, harsher, crueller than before, and over the dread undertone of the voice of Tamanoüs, tamanoüs voices again screamed, 'Ha, ha, ha, hiaqua!' and it seemed as if tamanoüs hands, or the paws of the demon otters, clutched at the miser's right-handful and tore at his shoulder and waist belts.

"So, while darkness and tempest still buffeted the hapless old man, and thrust him away from his path, and while the roaring was wickeder than the roars of tens and tens of tens of bears when ahungered they pounce upon a plain of kamas, gradually wounded and terrified he flung away string after string of hiaqua, gaining never any notice of such sacrifice, except an instant's lull of the cyclone and a puff from the invisible otters.

"The last string he clung to long, and before he threw it to be caught and whirled after its fellows, he tore off a single bunch of fifty shells. But upon this, too, the storm laid its clutches. In the final desperate

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struggle the old man was wounded so sternly that when he had given up his last relic of the mighty treasure, when he had thrown into the formless chaos, instinct with Tamanoüs, his last propitiatory offering, he sank and became insensible.

"It seemed a long slumber to him, but at last he awoke. The jagged moon was just paling overhead, and he heard Skai-ki, the Blue-Jay, foe to magic, singing welcome to sunrise. It was the very spot whence he started at morning.

"He was hungry, and felt for his bag of kamas and pouch of smokeleaves. There, indeed, by his side were the elk-sinew strings of the bag, and the black stone pipe-bowl, — but no bag, no kamas, no kinni kinnik. The whole spot was thick with kamas plants, strangely out of place on the mountain-side, and overhead grew a large arbutus-tree, with glistening leaves, ripe for smoking. The old man found his hardwood fire-sticks safe under the herbage, and soon twirled a light, and, nurturing it in dry grass, kindled a cheery fire. He plucked up kamas, set it to roast, and laid a store of the arbutus-leaves to dry on a flat stone.

"After he had made a hearty breakfast of the chestnut-like kamas-bulbs, and, smoking the thoughtful pipe, was reflecting on the events of yesterday, he became aware of an odd change in his condition. He was not bruised and wounded from head to foot, as he expected, but very stiff only, and as he stirred, his joints creaked like the creak of a lazy paddle upon the rim of a canoe. Skai-ki, the Blue-Jay, was singularly familiar with him, hopping from her perch in the arbutus, and alighting on his head. As he put his hand to dislodge her, he touched his scratching-stick of bone, and attempted to pass it, as usual, through his hair. The hair was matted and interlaced into a network reaching fully two ells down his back. 'Tamanoüs,' thought the old man.

"Chiefly he was conscious of a mental change. He

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was calm and content. Hiaqua and wealth seemed to have lost their charms for him. Tacoma, shining like gold and silver and precious stones of gayest lustre, seemed a benign comrade and friend. All the outer world was cheerful and satisfying. He thought he had never awakened to a fresher morning. He was a young man again, except for that unusual stiffness and unmelodious creaking joints. He felt no apprehension of any presence of a deputy tamanoüs, sent by Tamanoüs to do malignities upon him in the lonely wood. Great Nature had a kindly aspect, and made its divinity perceived only by the sweet notes of birds and the hum of forest life, and by a joy that clothed his being. And now he found in his heart a sympathy for man, and a longing to meet his old acquaintances down by the shores of Whulge.

"He rose, and started on the downward way, smiling, and sometimes laughing heartily at the strange croaking, moaning, cracking, and rasping of his joints. But soon motion set the lubricating valves at work, and the sockets grew slippery again. He marched rapidly, hastening out of loneliness into society. The world of wood, glade, and stream seemed to him strangely altered. Old colossal trees, firs behind which he had hidden when on the hunt, cedars under whose drooping shade he had lurked, were down, and lay athwart his path, transformed into immense mossy mounds, like barrows of giants, over which he must clamber warily, lest he sink and be half stifled in the dust of rotten wood. Had Tamanoüs been widely at work in that eventful night?—or had the spiritual change the old man felt affected his views of the outer world?

"Travelling downward, he advanced rapidly, and just before sunset came to the prairies where his lodge should be. Everything had seemed to him so totally altered, that he tarried a moment in the edge of the woods to take an observation before approaching his home. There was a lodge, indeed, in the old spot,

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but a newer and far handsomer one than he had left on the fourth evening before.

"A very decrepit old squaw, ablaze with vermilion and decked with countless strings of hiaqua and costly beads, was seated on the ground near the door, tending a kettle of salmon, whose blue and fragrant steam mingled pleasantly with the golden haze of sunset. She resembled his own squaw in countenance, as an ancient smoked salmon is like a newly-dried salmon. If she was indeed his spouse, she was many years older than when he saw her last, and much better dressed than the respectable lady had ever been during his miserly days.

"He drew near quietly. The bedizened dame was crooning a chant, very dolorous, — like this:

'My old man has gone, gone, gone, —
My old man to Tacoma, has gone.
To hunt the elk, he went long ago.
When will he come down, down, down,
Down to the salmon-pot and me?'

'He has come from Tacoma down, down, down, —
Down to the salmon-pot and thee,'

shouted the reformed miser, rushing forward to supper and his faithful wife."

"And how did Penelope explain the mystery?" I asked.

"If you mean the old lady," replied Hamitchou, "she was my grandmother, and I'd thank you not to call names. She told my grandfather that he had been gone many years; — she could not tell how many, having dropped her tally-stick in the fire by accident that very day. She also told him how, in despite of the entreaties of many a chief who knew her economic virtues, and prayed her to become mistress of his household, she had remained constant to the Absent, and forever kept the hopeful salmon-pot boiling for his return. She had distracted her mind from the

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bitterness of sorrow by trading in kamas and magic herbs, and had thus acquired a genteel competence. The excellent dame then exhibited with great complacency her gains, most of which she had put in the portable and secure form of personal ornament, making herself a resplendent magazine of valuable frippery.

"Little cared the repentant sage for such things. But he was rejoiced to be again at home and at peace, and near his own early gains of hiaqua and treasure, buried in a place of security. These, however, he no longer over-esteemed and hoarded. He imparted whatever he possessed, material treasures or stores of wisdom and experience, freely to all the land. Every dweller by Whulge came to him for advice how to chase the elk, how to troll or spear the salmon, and how to propitiate Tamanoüs. He became the Great Medicine Man of the siwashes, a benefactor to his tribe and his race.

"Within a year after he came down from his long nap on the side of Tacoma, a child, my father, was born to him. The sage lived many years, beloved and revered, and on his deathbed, long before the Boston tilicum or any blanketeers were seen in the regions of Whulge, he told this history to my father, as a lesson and a warning. My father, dying, told it to me. But I, alas! have no son; I grow old, and lest this wisdom perish from the earth, and Tamanoüs be again obliged to interpose against avarice, I tell the tale to thee, O Boston tyee. Mayest thou and thy nation not disdain this lesson of an earlier age, but profit by it and be wise."

So far Hamitchou recounted his legend without the palisades of Fort Nisqually, and motioning, in expressive pantomine, at the close, that he was dry with big talk, and would gladly wet his whistle.

[Chapter VIII, beginning at page 155 of the original publication, is entitled: "Sowee House—Loolowcan."]

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I had not long, that noon of August, from the top of La Tête, to study Tacoma, scene of Hamitchou's wild legend. Humanity forbade dalliance. While I fed my soul with sublimity, Klale and his comrades were wretched with starvation. But the summit of the pass is near. A few struggles more, Klale the plucky, and thy empty sides shall echo less drum-like. Up stoutly, my steeds; up a steep but little less than perpendicular, paw over these last trunks of the barricades in our trail, and ye have won!

So it was. The angle of our ascent suddenly broke down from ninety to fifteen, then to nothing. We had reached the plateau. Here were the first prairies. Nibble in these, my nags, for a few refreshing moments, and then on to superlative dinners in lovelier spots just beyond.

Let no one, exaggerating the joys of campaigning, with Horace's "Militia potior est," deem that there is no compensating pang among them. Is it a pleasant thing, O traveller only in dreams, envier of the voyager in reality, to urge tired, reluctant, and unfed mustangs up a mountain pass, even for their own good? In such a case a man, the humanest and gentlest, must adopt the manners of a brute. He must ply the whip, and that cruelly; otherwise, no go. At first, as he smites, he winces, for he has struck his own sensibilities; by and by he hardens himself, and thrashes without a tremor. When the cortege arrives at an edible prairie, gastronomic satisfaction will put Lethean freshness in the battered hide of every horse.

We presently turned just aside from the trail into an episode of beautiful prairie, one of a succession along the plateau at the crest of the range. At this height of about five thousand feet, the snows remain until June. In this fair, oval, forest-circled prairie of my nooning, the grass was long and succulent, as if it grew in the bed of a drained lake. The horses, undressed, were allowed to plunge and wallow in the deep

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herbage. Only horse heads soon could be seen, moving about like their brother hippopotami, swimming in sedges.

To me it was luxury enough not to be a whip for a time. Over and above this, I had the charm of a quiet nooning on a bank of emerald turf, by a spring, at the edge of a clump of evergreens. I took my luncheon of cold salt pork and doughy biscuit by a well of brightest water. I called in no proxy of tin cup to aid me in saluting this sparkling creature, but stooped and kissed the spring. When I had rendered my first homage thus to the goddess of the fountain, Ægle herself, perhaps, fairest of Naiads, I drank thirstily of the medium in which she dwelt. A bubbling dash of water leaped up and splashed my visage as I withdrew. Why so, sweet fountain, which I may name Hippocrene, since hoofs of Klale have caused me thy discovery? Is this a rebuff? If there ever was lover who little merited such treatment it is I. "Not so, appreciative stranger," came up in other bubbling gushes the responsive voice of Nature through sweet vibrations of the melodious fount. "Never a Nymph of mine will thrust thee back. This sudden leap of water was a movement of sympathy, and a gentle emotion of hospitality. The Naiad there was offering thee her treasure liberally, and saying that, drink as thou wilt, I, her mother Nature, have commanded my winds and sun to distil thee fresh supplies, and my craggy crevices are filtering it in the store-houses, that it may be offered to every welcome guest, pure and cool as airs of dawn. Stoop down," continued the voice, "thirsty wayfarer, and kiss again my daughter of the fountain, nor be abashed if she meets thee halfway. She knows that a true lover will never scorn his love's delicate advances."

In response to such invitation, and the more for my thirsty slices of pork, I lapped the aerated tipple in its goblet, whose stem reaches deep into the bubble

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laboratories. I lapped, — an excellent test of pluck in the days of Gideon son of Barak; — and why? For many reasons, but among them for this; — he who lying prone can with stout muscular gullet swallow water, will be also able to swallow back into position his heart, when in moments of tremor it leaps into his throat.

When I had lapped plenteously, I lay and let the breeze-shaken shadows smooth me into smiling mood, while my sympathies overflowed to enjoy with my horses their dinner. They fed like school-boys home for Thanksgiving, in haste lest the present banquet, too good to be true, prove Barmecide. A feast of colossal grasses placed itself at the lips of the breakfastless stud. They champed as their nature was; — Klale like a hungry gentleman, — Gubbins like a hungry clodhopper, — Antipodes like a lubberly oaf. They were laying in, according to the Hudson's Bay Company's rule, supply at this meal for five days; without such power, neither man nor horse is fit to tramp the Northwest.

I lay on the beautiful verdant bank, plucking now dextrously and now sinistrously of strawberries, that summer, climbing late to these snowy heights, had just ripened. Medical men command us to swallow twice a day one bitter pill confectioned of all disgust. Nature doses us, by no means against our will, with many sweet boluses of delight, berries compacted of acidulated, sugary spiciness. Nature, tenderest of leeches, — no bolus of hers is pleasanter medicament than her ruddy strawberries. She shaped them like Minié-balls, that they might traverse unerringly to the cell of most dulcet digestion. Over their glistening surfaces she peppered little golden dots to act as obstacles lest they should glide too fleetly over the surfaces of taste, and also to gently rasp them into keener sensitiveness. Mongers of pestled poisons may punch their pills in malodorous mortars, roll them in floury palms,

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pack them in pink boxes, and send them forth to distress a world of patients: — but Nature, who if she even feels one's pulse does it by a gentle pressure of atmosphere, — Nature, knowing that her children in their travels always need lively tonics, tells wind, sun, and dew, servitors of hers, clean and fine of touch, to manipulate gay strawberries, and dispose them attractively on fair green terraces, shaded at parching noon. Of these lovely fabrics of pithy pulpiness, no limit to the dose, if the invalid does as Nature intended, and plucks for himself, with fingers rosy and fragrant. I plucked of them, as far as I could reach on either side of me, and then lay drowsily reposing on my couch at the summit of the Cascade Pass, under the shade of a fir, which, outstanding from the forest, had changed its columnar structure into a pyramidal, and had branches all along its stalwart trunk, instead of a mere tuft at the top.

In this shade I should have known the tree which gave it, without looking up, — not because the sharp little spicular leaves of the fir, miniatures of that sword Rome used to open the world, its oyster, would drop and plunge themselves into my eyes, or would insert their blades down my back and scarify, — but because there is an influence and sentiment in umbrages, and under every tree its own atmosphere. Elms refine and have a graceful elegiac effect upon those they shelter. Oaks drop robustness. Mimosas will presently make a sensitive-plant of him who hangs his hammock beneath their shade. Cocoa-palms will infect him with such tropical indolence, that he will not stir until frowzy monkeys climb the tree and pelt him away to the next one. The shade of pine-trees, as any one can prove by a journey in Maine, makes those who undergo it wiry, keen, trenchant, inexhaustible, and tough.

When I had felt the influence of my fir shelter, on the edge of the wayside prairie, long enough, I became of course keen as a blade. I sprang up and called to

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Loolowcan, in a resinous voice, "Mamook chaco cuitan; make come horse."

Loolowcan, in more genial mood than I had known him, drove the trio out from the long grass. They came forth not with backward hankerings, but far happier quadrupeds than when they climbed the pass at noon. It was a pleasure now to compress with the knees Klale, transformed from an empty barrel with protuberant hoops, into a full elastic cylinder, smooth as the boiler of a locomotive.

"Loolowcan, my lad, my experienced guide, cur nesika moosum; where sleep we?" said I.

"Copa Sowee house, — kicuali. Sowee, olyman tyee, — memloose. Sia-a-ah mitlite; — At Sowee's camp — below. Sowee, oldman chief, — dead. It is far, far away," replied the son of Owhhigh.

Far is near, distance is annihilated this brilliant day of summer, for us recreated with Hippocrene, strawberries, shade of fir and tall snow-fed grass. Down the mountain range seems nothing after our long laborious up; "the half is more than the whole." "Lead on, Loolowcan, intelligent brave, toward the residence of the late Sowee."

More fair prairies linked themselves along the trail. From these alpine pastures the future will draw butter and cheese, pasturing migratory cattle there, when summer dries the scanty grass upon the macadamized prairies of Whulge. It is well to remind ourselves sometimes that the world is not wholly squatted over. The plateau soon began to ebb toward the downward slope. Descent was like ascent, a way shaggy and abrupt. Again the Boston hooihut intruded. My friends the woodsmen had constructed an elaborate inclined plane of very knobby corduroy. Klale sniffed at this novel road, and turned up his nose at it. He was competent to protect that feature against all the perils of stumble and fall on the trails he had been educated to travel, but dreaded grinding it on the

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rough bark of this unaccustomed highway. Slow-footed oxen, leaning inward and sustaining each other, like two roysterers unsteady after wassail, might clumsily toil up such a road as this, hauling up stout, white-cotton-roofed wagons, filled with the babies and Lares of emigrants; but quick-footed ponies, descending and carrying light loads of a wild Indian and an untamed blanketeer, chose rather to whisk along the aboriginal paths.

As we came to the irregular terraces after the first pitch, and scampered on gayly, I by and by heard a welcome whiz, and a dusky grouse (*Tetrao obscurus*) lifted himself out of the trail into the lower branches of a giant fir. I had lugged my double-barrel thus far, a futile burden, unless when it served a minatory purpose among the drunken Klalams. Now it became an animated machine, and uttered a sharp exclamation of relief after long patient silence. Down came tetrao, — down he came with satisfactory thud, signifying pounds of something not pork for supper. We bagged him joyously and dashed on.

"Kopet," whispered Loolowcan turning, with a hushing gesture, "hiu kullakullie nika nanitch; — halt, plenty birds I see." He was so eager that from under his low brows and unkempt hair his dusky eyes glared like the eyes of wild beast, studying his prey from a shadowy lair.

Dismounting, I stole forward with assassin intent, and birds, grouse, five noble ones I saw, engaged in fattening their bodies for human solace and support. I sent a shot among them. There was a flutter among the choir, — one fluttered not. At the sound of my right barrel one bird fell without rising; another rose and fell at a hint from the sinister tube. The surviving trio were distracted by mortal terror. They flew no farther than a dwarf tree hard by. I drew my revolver, thinking that there might not be time to load, and fired in a hurry at the lowermost.

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"Hyas tamanoüs!" whispered Loolowcan, when no bird fell or flew, — "big magic," it seemed to the superstitious youth. Often when sportsmen miss, they claim that their gun is bewitched, and avail themselves of the sure silver bullet.

A second ball, passing with keener aim through the barrel, attained its mark. Grouse third shook off his mortal remains, and sped to heaven. The two others, contrary to rule, for I had shot the lower, fled, cowardly carrying their heavy bodies to die of cold, starvation, or old age. "The good die first," — ay, Wordsworth! among birds this is verity; for the good are the fat, who, because of their avoirdupois, lag in flight, or alight upon lower branches and are easiest shot.

Loolowcan bagged my three trophies and added them to the first. Henceforth the thought of a grouse supper became a fixed idea with me. I dwelt upon it with even a morbid appetite. I rehearsed, in prophetic mood, the scene of plucking, the scene of roasting, that happy festal scene of eating. So immersed did I become in gastronomic revery, that I did not mind my lookout, as I dashed after Loolowcan, fearless and agile cavalier. A thrust awoke me to a sense of passing objects, a very fierce, lance-like thrust, full at my life. A wrecking snag of harsh dead wood, that projected up in the trail, struck me, and tore me half off my horse, leaving me jerked, scratched, disjointed, and shuddering. Pachydermatous leggins of buckskin, at cost of their own unity, had saved me from impalement. Some such warning is always preparing for the careless.

I soon had an opportunity to propitiate Nemesis by a humane action. A monstrous trunk lay across the trail. Loolowcan, reckless steeplechaser, put his horse at it, full speed. Gubbins, instead of going over neatly, or scrambling over cat-like, reared rampant and shied back, volte face. I rode forward to see what fresh interference of Tamanoüs was here, —

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nothing tamanoüs but an unexpected sorry object of a horse. A wretched castaway, probably abandoned by the exploring party, or astray from them, essaying to leap the tree, had fallen back beneath the trunk and branches, and lay there entangled and perfectly helpless. We struggled to release him. In vain. At last a thought struck me. We seized the poor beast by his tail, fortunately a tenacious member, and, heaving vigorously, towed him out of prison.

He tottered forlornly to his feet, looking about him like one risen from the dead. "How now, Caudal?" said I, baptizing him by the name of the part that saved his life; "canst thou follow toward fodder?" He debated the question with himself awhile. Solitary confinement of indefinite length, in a cramped posture, had given the poor skeleton time to consider that safety from starvation is worth one effort more. He found that there was still a modicum of life and its energy within his baggy hide. My horses seemed to impart to him some of their electricity, and he staggered on droopingly. Lucky Caudal, if life is worth having, that on that day, of all days, I should have arrived to rescue him. Strange deliverances for body and soul come to the dying. Fate sends unlooked-for succor, when or horses or men despair.

Luckily for Caudal, the weak-kneed and utterly dejected, Sowee's prairie was near, — near was the prairie of Sowee, mighty hunter of deer and elk, terror of bears. There at weird night Sowee's ghost was often seen to stalk. Dyspeptics from feather-beds behold ghosts, and are terrified, but nightwalkers are but bugbears to men who have ridden from dawn to dusk of a long summer's day over an Indian trail in the mountains. I felt no fear that any incubus in the shape of a brassy-hued Indian chief would sit upon my breast that night, and murder wholesome sleep.

Nightfall was tumbling down from the zenith before we reached camp. The sweet glimmers of twilight were

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ousted from the forest, sternly as mercy is thrust from a darkening heart. Night is really only beautiful so far as it is not night, — that is, for its stars, which are sources of resolute daylight in other spheres, and for its moon, which is daylight's memory, realized, softened, and refined.

Night, however, had not drawn the pall of brief death over the world so thick but that I could see enough to respect the taste of the late Sowee. When he voted himself this farm, and became seized of it in the days of unwritten agrarian laws, and before patents were in vogue, he proved his intelligent right to suffrage and seizure. Here in admirable quality were the three first requisites of a home in the wilderness, water, wood, and grass. A musical rustle, as we galloped through, proved the long grass. All around was the unshorn forest. There were columnar firs making the Sowee house a hypæthral temple on a grand scale.

There had been here a lodge. A few saplings of its framework still stood, but Sowee had moved elsewhere not long ago. Wake siah memloose, — not long dead was the builder, and viator might camp here unquestioned.

Caudal had followed us in inane, irresponsible way. Patiently now he stood, apparently waiting for farther commands from his preservers. We unpacked and unsaddled the other animals. They knew their business, namely, to bolt instantly for their pasture. Then a busy uproar of nipping and crunching was heard. Poor Caudal would not take the hint. We were obliged to drive that bony estray with blows out to the supper-field, where he stood aghast at the appetites of his new comrades. Repose and good example, however, soon had their effect, and eight equine jaws instead of six made play in the herbage.

"Alki mika mamook pire, pe nesika klatawah copa klap tsuk; now light thou a fire, and we will go find

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water," said Loolowcan. I struck fire, — fire smote tinder, — tinder sent the flame on, until a pyre from the world's free wood-pile was kindled. This boon of fire, — what wonder that men devised a Prometheus greatest of demigods as its discoverer? Mortals, shrinking from the responsibility of a high destiny and dreading to know how divine the Divine would have them, always imagine an avatar of some one not lower than a half-god when a gift of great price comes to the world. And fire is a very priceless and beautiful boon, — not, as most know it, in imprisonment, barred with iron, or in sooty chimneys, or in mad revolt of conflagration, — but as it grows in a flashing pyramid out in camp in the free woods, with eager air hurrying in on every side to feed its glory. In the gloom I strike metal of steel against metallic flint. From this union a child is born. I receive the young spark tenderly in warm "tipsoo," in a soft woolly nest of bark or grass tinder. Swaddled in this he thrives. He smiles; he chuckles; he laughs; he dances about, does my agile nursling. He will soon wear out his first infantile garb, so I cover him up in shelter. I feed him with digestible viands, according to his years. I give him presently stouter fare, and offer exhilarating morsels of fatness. All these the hearty youth assimilates, and grows healthily. And now I educate him to manliness, training him on great joints, shoulders, and marrowy portions. He becomes erelong a power and a friend able to requite me generously for my care. He aids me in preparing my feast, and we feast together. Afterward we talk, — Flame and I, — we think together strong and passionate thoughts of purpose and achievement. These emotions of manhood die away, and we share pensive memories of happiness missed, or disdained, or feebly grasped and torn away; regrets cover these like embers, and slowly over dead fieriness comes a robe of ashy gray.

Fire in the forest is light, heat, and cheer. When

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ours was nurtured to the self-sustaining point, we searched to find where the sage Sowee kept his potables. Carefully covered up in sedges was a slender supply of water, worth concealing fron vulgar dabblers. Its diamond drops were hidden away so thoroughly that we must mine for them by torchlight. I held a flaring torch, while Loolowcan lay in wait for the trickle, and captured it in a tin pot. How wild he looked, that youth so frowzy by daylight, as, stooping under the tall sedges, he clutched those priceless sparkles.

Upon the *carte du jour* at Restaurant Sowee was written Grouse. "How shall we have them?" said I, cook and convive, to Loolowcan, marmiton and convive. "One of these cocks of the mountain shall be fried, since gridiron is not," said I to myself, after meditation. "Two shall be spitted, and roasted; and, as Azrael may not want us before breakfast tomorrow, the fourth shall go on the *carte de dejeuner*."

"O Pork! what a creature thou art!" continued I, in monologue, cutting neat slices of that viand with my bowie-knife, and laying them fraternally, three in a bed, in the frying-pan. "Blessed be Moses! who forbade thee to the Jews, whereby we, of freer dispensations, heirs of all the ages, inherit also pigs more numerous and bacon cheaper. O Pork! what could campaigners do without thy fatness, thy leanness, thy saltness, thy portableness?"

Here Loolowcan presented me the three birds plucked featherless as Plato's man. The two roasters we planted carefully on spits before a sultry spot of the fire. From a horizontal stick, supported on forked stakes, we suspended by a twig over each roaster an automatic baster, an inverted cone of pork, ordained to yield its spicy juices to the wooing flame, and drip bedewing on each bosom beneath. The roasters ripened deliberately, while keen and quick fire told upon the fryer, the first course of our feast. Mean-

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while I brewed a pot of tea, blessing Confucius for that restorative weed, as I had blessed Moses for his abstinence from porkers.

Need I say that the grouse was admirable, that everything was delicious, and the Confucian weed first chop? Even a scouse of mouldy biscuit met the approval of Loolowcan. Feasts cooked under the greenwood tree, and eaten by their cooks after a triumphant day of progress, are sweeter than the conventional banquets of languid Christendom. After we had paid our duty to the brisk fryer and the rotund roaster grouse, nothing remained but bones to propitiate Sowee, should he find short commons in Elysium, and wander back to his lodge, seeking what he might devour.

All along the journey I had been quietly probing the nature of Loolowcan, my most intimate associate thus far among the unalloyed copper-skins. Chinook jargon was indeed but a blunt probe, yet perhaps delicate enough to follow up such rough bits of conglomerate as served him for ideas. An inductive philosopher, tracing the laws of developing human thought *in corpore viti* of a frowzy savage, finds his work simple, — the nuggets are on the surface. Those tough pebbles known to some metaphysicians as innate ideas, can be studied in Loolowcan in their process of formation out of instincts.

Number one is the prize number in Loolowcan's lottery of life. He thinks of that number; he dreams of it alone. When he lies down to sleep, he plots what he will do in the morning with his prize and his possession; when he wakes, he at once proceeds to execute his plots. Loolowcan knows that there are powers out of himself; rights out of himself he does not comprehend, or even conceive. I have thus far been very indulgent to him, and treated him republicanly, mindful of the heavy mesne profits for the occupation of a continent, and the uncounted arrears of

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blood-money owed by my race to his; yet I find no trace of gratitude in my analysis of his character. He seems to be composed, selfishness, five hundred parts; — *nil admirari* coolness, five hundred parts; — a well-balanced character, and perhaps one not likely to excite enthusiasm in others. I am a steward to him; I purvey him also a horse; when we reach the Dalles, I am to pay him for his services; — but he is bound to me by no tie of comradery. He has caution more highly developed than any quadruped I have met, and will not offend me lest I should resign my stewardship, retract Gubbins, refuse payment, discharge my guide, and fight through the woods, where he sees I am no stranger, alone. He certainly merits a "teapot" for his ability in guidance. He has memory and observation unerring; not once in all our intricate journey have I found him at fault in any fact of space or time. He knows "each lane and every ally green" here, accurately as Comus knew his "wild wood."

Moral conceptions exist only in a very limited degree for this type of his race. Of God he knows somewhat less than the theologians; that is, he is in the primary condition of uninquisitive ignorance, not in the secondary, of inquisitive muddle. He has the advantage of no elaborate system of human inventions to unlearn. He has no distinct fetichism. None of the North American Indians have, in the accurate sense of the term; their nomad life and tough struggle with instructive Nature in her roughness save them from such elaborate fetichism as may exist in more indolent climes and countries.

Loolowcan has his tamanoüs. It is Talipus, the Wolf, a "hyas skookoom tamanoüs, a very mighty demon," he informs me. He does not worship it; that would interfere with his devotions to his real deity, Number One. It, in return, does him little service. If he met Talipus, object of his superstition,

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on a fair morning, he would think it a good omen; if on a sulky morning, he might be somewhat depressed, but would not on that account turn back, as a Roman brave would have done on meeting the matinal wolf. In fact, he keeps Talipus, his tamanoüs, as a kind of ideal hobby, very much as a savage civilized man entertains a pet bulldog or a tame bear, a link between himself and the rude, dangerous forces of nature. Loolowcan has either chosen his protector according to the law of likeness, or, choosing it by chance, has become assimilated to its characteristics. A wolfish youth is the *protégé* of Talipus, — an unfaithful, sinister, cannibal-looking son of a horse-thief. Wolfish likewise is his appetite; when he asks me for more dinner, and this without stint or decorum he does, he glares as if, grouse failing, pork and hard-tack gone, he could call to Talipus to send in a pack of wolves incarnate, and pounce with them upon me. A pleasant companion this for lamb-like me to lie down beside in the den of the late Sowee. Yet I do presently, after supper and a pipe, and a little jargoning in Chinook with my Wolf, roll into my blankets, and sleep vigorously, lulled by the gratifying noise of my graminivorous horses cramming themselves with material for leagues of lope to-morrow.

No shade of Sowee came to my slumbers with warning against the wolf in guise of a Klickatat brave. I had no ghostly incubus to shake off, but sprang up recreate in body and soul. Life is vivid when it thus awakes. To be is to do.

And to-day much is to be done. Long leagues away, beyond a gorge of difficulty, is the open rolling hill country, and again far beyond are the lodges of the people of Owhhigh. "To-day," said Loolowcan, "we must go copa nika ilihee, to my home, to Weenas."

Forlorn Caudal is hardly yet a frisky quadruped. Yet he is of better cheer, perhaps up to the family-nag degree of vivacity. As to the others, they have waxed

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fat, and kick. Klale, the Humorous, kicks playfully, elongating in preparatory gymnastics. Gubbins, the average horse, kicks calmly at his saddler, merely as a protest. Antipodes, the spiteful Blunderer, kicks in a revolutionary manner, rolls under his pack-saddle, and will not budge without maltreatment. Ill-educated Antipodes views mankind only as excoriators of his back, and general flagellants. Klickitats kept him raw in flesh and temper; under me his physical condition improves; his character is not yet affected.

Before sunrise we quitted the house of Sowee.

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General August Valentine Kautz.
United States Army.

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V. FIRST ATTEMPTED ASCENT, 1857

By LIEUTENANT A. V. KAUTZ, U.S.A.

August Valentine Kautz was born at Ispringen, Baden, Germany, on January 5, 1828. In that same year his parents came to America. On attaining manhood the son entered the army and served as a private soldier in the Mexican War. At its conclusion he was appointed to the Military Academy at West Point. Graduating in 1852, he was assigned to the Fourth Infantry and soon found himself in the Pacific Northwest. After going through the Indian wars here he achieved a brilliant record in the Civil War. Continuing in the army, he reached the rank of brigadier-general and was for a time in command of the Department of the Columbia. He died at Seattle on September 4, 1895.

It was while, as a lieutenant, he was stationed at Fort Steilacoom that he attempted to ascend Mount Rainier. His account of the trip was published in the Overland Monthly, May, 1875. It is here republished by permission of the editor. While the ascent was claimed to be complete the climber says there was still higher land above him, and it is now difficult to fix the exact altitude attained.

Professor I. C. Russell declares that Professor George Davidson made a statement before the California Academy of Sciences, on March 6, 1871, to the effect that when Lieutenant Kautz "attempted the ascent of Mount Rainier in 1857" he found his way barred by a great glacier. From this, says Professor Russell, it "seems that he first reported the existence of living glaciers in the United States." (See: Israel C. Russell: Glaciers of North America; Boston, Ginn & Company, 1897, p. 62). The portrait of General Kautz was furnished by his daughter, Mrs. Navana Kautz Simpson, of Cincinnati, Ohio.

In the summer of 1857 I was stationed at Fort Steilacoom, Washington Territory. This post was located near the village of Steilacoom, on the waters of Puget Sound. The post and the village took their names from a little stream near by, which is the out-

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let of a number of small lakes and ponds emptying into the sound. Quite a family of Indians made their permanent home in the vicinity of this creek in former years, and were known as "*Steilacoom Tillicum.*" According to the Indian pronunciation of the name it should have been spelled "Steelacoom," dwelling long on the first syllable.

I was at that time a first-lieutenant, young, and fond of visiting unexplored sections of the country, and possessed of a very prevailing passion for going to the tops of high places. My quarters fronted Mount Rainier, which is about sixty miles nearly east of Fort Steilacoom in an air line. On a clear day it does not look more than ten miles off, and looms up against the eastern sky white as the snow with which it is covered, with a perfectly pyramidal outline, except at the top, which is slightly rounded and broken. It is a grand and inspiring view, and I had expressed so often my determination to make the ascent, without doing it, that my fellow-officers finally became incredulous, and gave to all improbable and doubtful events a date of occurrence when I should ascend Mount Rainier.

My resolution, however, took shape and form about the first of July. Nearly all the officers had been very free to volunteer to go with me as long as they felt certain I was not going; but when I was ready to go, I should have been compelled to go alone but for the doctor, who was on a visit to the post from Fort Bellingham.

I made preparations after the best authorities I could find, from reading accounts of the ascent of Mont Blanc and other snow mountains. We made for each member of the party an *alpenstock* of dry ash with an iron point. We sewed upon our shoes an extra sole, through which were first driven four-penny nails with the points broken off and the heads inside. We took with us a rope about fifty feet long, a hatchet, a

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thermometer, plenty of hard biscuit, and dried beef such as the Indians prepare.

Information relating to the mountain was exceedingly meagre; no white man had ever been near it, and Indians were very superstitious and afraid of it. The southern slope seemed the least abrupt, and in that direction I proposed to reach the mountain; but whether to keep the high ground, or follow some stream to its source, was a question. Leshi, the chief of the Nesquallies, was at that time in the guard-house, awaiting his execution, and as I had greatly interested myself to save him from his fate, he volunteered the information that the valley of the Nesqually River was the best approach after getting above the falls. He had some hope that I would take him as a guide; but finding that out of the question he suggested Wah-pow-e-ty,[1] an old Indian of the Nesqually tribe, as knowing more about the Nesqually than any other of his people.

Mount Rainier is situated on the western side of the Cascade Range, near the forty-seventh parallel. The range to which it belongs averages about 7,000 to 8,000 feet in height, and snow may be seen along its summit-level the year round, while Rainier, with its immense covering of snow, towers as high again above the range. In various travels and expeditions in the territory, I had viewed the snow-peaks of this range from all points of the compass, and since that time having visited the mountain regions of Europe, and most of those of North America, I assert that Washington Territory contains mountain scenery in quantity and quality sufficient to make half a dozen Switzerlands, while there is on the continent none more grand and imposing than is presented in the Cascade Range north of the Columbia River.

About noon on the 8th of July [1857] we finally started. The party consisted of four soldiers — two

[1] His name is honored in Wapowety Cleaver overlooking the Kautz Glacier.

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of them equipped to ascend the mountain, and the other two to take care of our horses when we should be compelled to leave them. We started the soldiers on the direct route, with orders to stop at Mr. Wren's, on the eastern limit of the Nesqually plains, ten or twelve miles distant, and wait for us, while the doctor and I went by the Nesqually Reservation in order to pick up old Wah-pow-e-ty, the Indian guide.

We remained all night at Wren's, and the next morning entered that immense belt of timber with which the western slope of the Cascade Range is covered throughout its entire length. I had become familiar with the Indian trail that we followed, the year previous, in our pursuit of Indians. The little patches of prairie are so rare that they constitute in that immense forest landmarks for the guidance of the traveler. Six miles from Wren's we came to Pawhtummi, a little *camas* prairie about 500 yards long, and 100 in breadth, a resort for the Indians in the proper season to gather the *camas*-root. Six miles farther we came to a similar prairie, circular in form, not more than 400 yards in diameter, called Koaptil. Another six or seven miles took us to the Tanwut, a small stream with a patch of prairie bordering it, where the trail crossed. Ten or twelve miles more brought us to the Mishawl Prairie, where we camped for the night, this being the end of the journey for our horses, and the limit of our knowledge of the country.

This prairie takes its name from the stream near by, and is situated between it and the Owhap on a high table-land or bluff, not more than one or two miles from where these enter the Nesqually. It is perhaps half a mile long, and 200 or 300 yards wide at the widest point. The grass was abundant, and it was an excellent place to leave our horses. Fifteen months before, I had visited this spot, and camped near by with a small detachment of troops, searching for Indians who had hidden away in these forests,

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completely demoralized and nearly starving. A family of two or three men, and quite a number of women and children, had camped in the fork of the Mishawl and Nesqually, about two miles from this prairie, and were making fishtraps to catch salmon. When we fell in with them we learned that the Washington Territory volunteers had been before us, and with their immensely superior force had killed the most of them without regard to age or sex. Our own little command in that expedition captured about thirty of these poor, half-starved, ignorant creatures, and no act of barbarity was perpetrated by us to mar the memory of that success.

We accordingly camped in the Mishawl Prairie. When I was here before it was in March, and the rainy season was still prevailing; the topographical engineer of the expedition and I slept under the same blankets on a wet drizzly night, and next morning treated each other to bitter reproaches for having each had more than his share of the covering. Now the weather was clear and beautiful, and the scene lovely in comparison. I can imagine nothing more gloomy and cheerless than a fir-forest in Washington Territory on a rainy winter day. The misty clouds hang down below the tops of the tallest trees, and although it does not rain, but drizzles, yet it is very wet and cold, and penetrates every thread of clothing to the skin. The summers of this region are in extraordinary contrast with the winters. Clear, beautiful, and dry, they begin in May and last till November; while in the winter, although in latitude 47° and 48°, it rarely freezes or snows — often, however, raining two weeks without stopping a permeating drizzle.

On this 9th of July, 1857, the weather was beautiful; it had not rained for weeks. The Mishawl — a raging mountain torrent, when last I saw it — was now a sluggish rivulet of clear mountain-spring water. We started early on our journey, having made our

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preparations the evening before. We calculated to be gone about six days. Each member of the party had to carry his own provisions and bedding; everything was therefore reduced to the minimum. Each took a blanket, twenty-four crackers of hard bread, and about two pounds of dried beef. We took Dogue (a German) and Carroll (an Irishman) with us; they were both volunteers for the trip; one carried the hatchet and the other the rope. I carried a field-glass, thermometer, and a large-sized revolver. Wah-pow-e-ty carried his rifle, with which we hoped to procure some game. The soldiers carried no arms. Bell and Doneheh were left behind to take care of the horses and extra provisions, until our return.

We each had a haversack for our provisions, and a tin canteen for water. The doctor very unwisely filled his with whisky instead of water. Having sounded Wah-pow-e-ty as to the route, we learned he had once been on the upper Nesqually when a boy, with his father, and that his knowledge of the country was very limited. We ascertained, however, that we could not follow the Nesqually at first; that there was a fall in the river a short distance above the mouth of the Mishawl, and that the mountains came down so abrupt and precipitous that we could not follow the stream, and that the mountain must be crossed first and a descent made to the river above the fall.

That mountain proved a severer task than we anticipated. There was no path and no open country — only a dense forest, obstructed with undergrowth and fallen timber. The sun was very hot when it could reach us through the foliage; not a breath of air stirred, and after we crossed the Mishawl, not a drop of water was to be had until we got down to low ground again. We toiled from early morning until three o'clock in the afternoon before we reached the summit. As the doctor had taken whisky instead of water in his canteen, he found it necessary to apply to

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the other members of the party to quench his thirst, and our canteens were speedily empty. The doctor sought relief in whisky, but it only aggravated his thirst, and he poured out the contents of his canteen. The severe exertion required for the ascent brought on painful cramps in his legs, and at one time, about the middle of the day, I concluded that we should be obliged to leave him to find his way back to camp while we went on without him; but he made an agreement with Wah-pow-e-ty to carry his pack for him in addition to his own, for ten dollars, and the doctor was thus enabled to go on. Here was an illustration of the advantage of training. The doctor was large, raw-boned, and at least six feet high, looking as if he could have crushed with a single blow the insignificant old Indian, who was not much over five feet, and did not weigh more than half as much as the doctor; but, inured to this kind of toil, he carried double the load that any of the party did, while the doctor, who was habituated to a sedentary life, had all he could do, carrying no load whatever, to keep up with the Indian.

Early in the afternoon we reached the summit of the first ascent, where we enjoyed, in addition to a good rest, a magnificent view of the Puget Sound Valley, with Mount Olympus and the Coast Range for a background. Here on this summit, too, munching our biscuit of hard bread and our dried beef, we enjoyed a refreshing breeze as we looked down on the beautiful plains of the Nesqually, with its numerous clear and beautiful little lakes. There was nothing definite except forest — of which there was a great excess — lakes, and plains of limited area, the sound, and a great background of mountains. No habitations, farms, or villages were to be seen; not a sign of civilization or human life.

After a good rest we pushed on, taking an easterly course, and keeping, or trying to keep, on the spur of

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the mountain; the forest was so thick, however, that this was next to an impossibility. We were not loth to go down into ravines in the hope of finding some water, for we needed it greatly. It was a long time, and we met with many disappointments, before we could find enough to quench our thirst. Our progress was exceedingly slow on account of the undergrowth. At sundown we camped in the grand old forest, the location being chosen on account of some water in a partially dry ravine. The distance passed over from Mishawl Prairie we estimated at about ten or eleven miles. On good roads thirty miles would have wearied us much less.

We started early the next morning, and for a time tried to keep the high ground, but found it so difficult that we finally turned down to the right, and came upon the Nesqually River about the middle of the afternoon. There was no material difference in the undergrowth, but there was an advantage gained in having plenty of water to quench our thirst. We made about ten miles this day, and camped about sundown. There seemed nothing but forest before us; dark, gloomy forest, remarkable for large trees, and its terrible solitude. But few living things were to be seen. The Nesqually is a very wide muddy torrent, fordable in places where the stream is much divided by islands.

We already here began to suffer from the loss of appetite, which was to us such a difficulty throughout the entire trip. Even the four crackers and two ounces of dried beef, which was our daily limit, we found ourselves unable to master, and yet so much was necessary to keep up our strength. I have never been able to settle in my mind whether this was due to the sameness of the food or the great fatigue we underwent.

The third morning we made an early start, and followed up the stream in almost a due east direction

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all day until about five o'clock, when the doctor broke down, having been unable to eat anything during the day. With considerable cramming I managed to dispose of the most of my rations. We kept the north side of the river, and had no streams to cross; in fact, there did not appear to be any streams on either side putting into the river. The valley seemed several miles in width, densely timbered, and the undergrowth a complete thicket. Not more than ten miles were made by us. Just before we stopped for the night, we passed through a patch of dead timber of perhaps 100 acres, with an abundance of blackberries. Opposite our camp, on the south side of the river, there was the appearance of quite a tributary coming in from the southeast.

We did not get started until about eleven o'clock on the fourth morning. After cutting up a deer which Wah-pow-e-ty brought in early in the norning, we dried quite a quantity of it by the fire. As we anticipated, it proved of much assistance, for we already saw that six days would be a very short time in which to make the trip. By night we reached a muddy tributary coming in from the north, and evidently having its source in the melting snows of Rainier. The summit of the mountain was visible from our camp, and seemed close at hand; but night set in with promise of bad weather. The valley had become quite narrow. Our camp was at the foot of a mountain spur several thousand feet high, and the river close at hand. The gloomy forest, the wild mountain scenery, the roaring of the river, and the dark overhanging clouds, with the peculiar melancholy sighing which the wind makes through a fir forest, gave to our camp at this point an awful grandeur.

On the fifth morning the clouds were so threatening, and came down so low on the surrounding mountains, that we were at a loss what course to pursue — whether to follow up the main stream or the tributary at our

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camp, which evidently came from the nearest snow. We finally followed the main stream, which very soon turned in toward the mountain, the valley growing narrower, the torrent more and more rapid, and our progress slower and slower, especially when we were compelled to take to the timber. We often crossed the torrent, of which the water was intensely cold, in order to avoid the obstructions of the forest. Sometimes, however, the stream was impassable, and then we often became so entangled in the thickets as almost to despair of farther advance. Early in the evening we reached the foot of an immense glacier and camped. For several miles before camping the bed of the stream was paved with white granite bowlders, and the mountain gorge became narrower and narrower. The walls were in many places perpendicular precipices, thousands of feet high, their summits hid in the clouds. Vast piles of snow were to be seen along the stream — the remains of avalanches — for earth, trees, and rocks were intermingled with the snow.

As it was near night we camped, thinking it best to begin the ascent in the early morning; besides, the weather promised to become worse. The foliage of the pine-trees here was very dense, and on such a cloudy day it was dark as night in the forest. The limbs of the trees drooped upon the ground, a disposition evidently given to them by the snow, which must be late in disappearing in this region.

We followed thus far the main branch of the Nesqually, and here it emerged from an icy cavern at the foot of an immense glacier. The ice itself was of a dark-blue tinge. The water was white, and whenever I waded the torrent my shoes filled with gravel and sand. The walls of this immense mountain gorge were white granite, and, just where the glacier terminated, the immense vein of granite that was visible on both sides seemed to form a narrow throat to the great ravine, which is much wider both above and

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below. The water seems to derive its color from the disintegration of this granite.*

We made our camp under a pine of dense foliage, whose limbs at the outer end drooped near the ground. We made our cup of tea, and found the water boil at 202° Fahrenheit. Night set in with a drizzling rain, and a more solitary, gloomy picture than we presented at that camp it is impossible to conceive. Tired, hungry, dirty, clothes all in rags — the effects of our struggles with the brush — we were not the least happy; the solitude was oppressive. The entire party, except myself, dropped down and did not move unless obliged to. I went up to the foot of the glacier, and explored a little before night set in. I also tried to make a sketch of the view looking up the glacier; but I have never looked at it since without being forcibly reminded what a failure it is as a sketch.

On the morning of the sixth day we set out again up the glacier. A drizzling rain prevailed through the night, and continued this morning. We had a little trouble in getting upon the glacier, as it terminated everywhere in steep faces that were very difficult to climb. Once up, we did not meet with any obstructions or interruptions for several hours, although the slippery surface of the glacier, which formed inclined planes of about twenty degrees, made it very fatiguing with our packs. About noon the weather thickened; snow, sleet, and rain prevailed, and strong winds, blowing hither and thither, almost blinded us. The surface of the glacier, becoming steeper, began to be intersected by immense crevasses crossing our path, often compelling us to travel several hundred yards to gain a few feet. We finally resolved to find a camp. But getting off the glacier was no easy task. We found

* I have no doubt that the south branch of the Nachess, which flows to the east into the Columbia, and that the Puyallup and White rivers, which flow west into Puget Sound, have similar sources in glaciers, from the fact that in July they are all of a similar character with the Nesqually, muddy, white torrents, at a time when little rain has fallen for months. — Kautz.

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that the face of the lateral moraine was almost perpendicular, and composed of loose stones, sand, and gravel, furnishing a very uncertain foothold, besides being about fifty feet high. Wah-pow-e-ty and I finally succeeded in getting up, and with the aid of the rope we assisted our companions to do the same. When we reached the top we were a little surprised to find that we had to go down-hill again to reach the mountain side. Here a few stunted pines furnished us fuel and shelter, and we rested for the remainder of the day. I explored a little in the evening by ascending the ridge from the glacier, and discovered that it would be much the best route to pursue in ascending to the summit.

When night set in, the solitude of our camp was very oppressive. We were near the limit of perpetual snow. The water for our tea we obtained from the melting of the ice near by. The atmosphere was very different from what it was below, and singularly clear when not obstructed by fog, rain, or snow. There were no familiar objects to enable one to estimate distance. When I caught a glimpse of the top of Rainier through the clouds, I felt certain that we could reach it in three hours. The only living things to be seen were some animals, with regard to which we still labor under an error. These little creatures would make their appearance on the side of the mountain in sight of our camp, and feed upon herbage that grew on the soil where the snow left it bare. The moment anyone stirred from camp, a sound between a whistle and scream would break unexpectedly and from some unknown quarter, and immediately all the animals that were in sight would vanish in the earth. Upon visiting the spot where they disappeared, we would find a burrow which was evidently the creatures' home. Everywhere round the entrance we found great numbers of tracks, such as a lamb or kid would make. The animals that we saw were about the size of kids, and

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grazed and moved about so much like them, that, taken in connection with the tracks we saw, we jumped at once to the conclusion that they were mountain sheep, of which we all had heard a great deal, but none of our party had ever seen any. My report of these animals, which was published in the *Washington Republican* on our return, was severely ridiculed by some of the naturalists who were hunting for undescribed insects and animals in that country at the time. We are still at a loss to understand the habits of the creatures, and to reconcile the split hoofs which the tracks indicated with their burrow in the earth.[1]

On the following morning — the seventh day from our camp on the Mishawl — the sky showed signs of clear weather, and we began the ascent of the main peak. Until about noon we were enveloped in clouds, and only occasionally did we get a glimpse of the peak. Soon after midday we reached suddenly a colder atmosphere, and found ourselves all at once above the clouds, which were spread out smooth and even as a sea, above which appeared the snowy peaks of St. Helens, Mount Adams, and Mount Hood, looking like pyramidal icebergs above an ocean. At first we could not see down through the clouds into the valleys. Above, the atmosphere was singularly clear, and the reflection of the sun upon the snow very powerful. The summit of Rainier seemed very close at hand.

About two o'clock in the afternoon the clouds rolled away like a scroll; in a very short time they had disappeared, and the Cascade Range lay before us in all its greatness. The view was too grand and extensive to be taken in at once, or in the short time we had to observe. The entire scene, with few exceptions, was covered with forests, with here and there barren rocky peaks that rose up out of the ridges; now and then a mountain lake, much more blue than the sky,

[1] The burrow was made by the marmot and the split-hoof tracks in the loose earth were made by mountain goats.

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and the Nesqually, winding like a thread of silver through the dark forests. From the foot of the glacier for several miles the bed of the river was very white, from the granite bowlders that covered the bed of the stream. The water, too, was of a decidedly chalkier color near its source.

We had no time, however, to study the beauties that lay before us. We had already discovered that there was no telling from appearances how far we had to go. The travel was very difficult; the surface of the snow was porous in some places, and at each step we sunk to our knees. Carroll and the Indian gave out early in the afternoon, and returned to camp. The doctor began to lag behind. Dogue stuck close to me. Between four and five o'clock we reached a very difficult point. It proved to be the crest of the mountain, where the comparatively smooth surface was much broken up, and inaccessible pinnacles of ice and deep crevasses interrupted our progress. It was not only difficult to go ahead, but exceedingly dangerous; a false step, or the loss of a foot-hold, would have been certain destruction. Dogue was evidently alarmed, for every time that I was unable to proceed, and turned back to find another passage, he would say, "*I guess, Lieutenant, we petter go pack.*"

Finally we reached what may be called the top, for although there were points higher yet,[1] the mountain spread out comparatively flat, and it was much easier to get along. The soldier threw himself down exhausted, and said he could go no farther. The doctor was not in sight. I went on to explore by myself, but I returned in a quarter of an hour without my hat, fully satisfied that nothing more could be done. It was after six o'clock, the air was very cold, and the wind blew fiercely, so that in a second my hat which it carried away was far beyond recovery. The ice was forming in my canteen, and to stay on the mountain at such

[1] He here gives evidence that he had not reached the summit.

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a temperature was to freeze to death, for we brought no blankets with us, and we could not delay, as it would be impossible to return along the crest of the mountain after dark. When I returned to where I had left the soldier, I found the doctor there also, and after a short consultation we decided to return.

Returning was far easier and more rapid than going. The snow was much harder and firmer, and we passed over in three hours, coming down, what required ten in going up. We were greatly fatigued by the day's toil, and the descent was not accomplished without an occasional rest of our weary limbs. In one place the snow was crusted over, and for a short distance the mountain was very steep, and required the skillful use of the stick to prevent our going much faster than we desired. The soldier lost his footing, and rolled helplessly to the foot of the declivity, thirty or forty yards distant, and his face bore the traces of the scratching for many a day after, as if he had been through a bramble-bush.

We found the Indian and Carroll in the camp. The latter had a long story to tell of his wanderings to find camp, and both stated that the fatigue was too much for them. There was no complaint on the part of any of us about the rarity of the atmosphere. The doctor attributed to this cause the fact that he could not go but a few yards at a time, near the summit, without resting; but I am inclined to think this was due to our exhaustion. My breathing did not seem to be in the least affected.

We were much disappointed not to have had more time to explore the summit of the mountain. We had, however, demonstrated the feasibility of making the ascent. Had we started at dawn of day we should have had plenty of time for the journey. From what I saw I should say the mountain top was a ridge perhaps two miles in length and nearly half a mile in width, with an angle about half-way, and depressions

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between the angle and each end of the ridge which give to the summit the appearance of three small peaks as seen from the east or west. When viewed from north or south, a rounded summit is all that can be seen; while viewed from positions between the cardinal points of the compass, the mountain generally has the appearance of two peaks.

The night was very cold and clear after our return. We had some idea of making another ascent; but an investigation into the state of our provisions, together with the condition of the party generally, determined us to begin our return on the morning of the eighth day. The two soldiers had eaten all their bread but one cracker each. The doctor and I had enough left, so that by a redistribution we had four crackers each, with which to return over a space that had required seven days of travel coming. We, of course, expected to be a shorter time getting back; but let it be ever so short, our prospect for something to eat was proportionately much more limited. We had more meat than bread, thanks to the deer the Indian had killed, and we depended greatly on his killing more game for us going back: but this dependence, too, was cut off; the Indian was snow-blind, and needed our help to guide him. His groans disturbed us during the night, and what was our astonishment in the morning to find his eyelids closed with inflammation, and so swollen that he looked as if he had been in a free fight and got the worst of it. He could not have told a deer from a stump the length of his little old rifle.

Our camp was about 1,000 or 1,500 feet below the last visible shrub; water boiled at 199°, and, according to an approximate scale we had with us, this indicated an elevation of 7,000 feet. We estimated the highest peak to be over 12,000 feet high. I greatly regretted not being able to get the boiling-point on the top, but it was impossible to have had a fire in such a wind as prevailed round the summit.

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As we returned we had more leisure to examine and clearer weather to see the glacier than we had coming up. There was no medial moraine; but an icy ridge parallel to the lateral moraines, and about midway between them, extending as far as we ascended the glacier. The lateral moraines were not continuous, but were interrupted by the walls of the spurs where they projected into the glacier; between these points the lateral moraines existed. The glacier sloped away from the ridge to the moraines, more or less sharply, and it was no easy matter to get off the ice, owing to the steepness of the moraine. The ice melted by reflection from the face of the moraine, and formed a difficult crevasse between it and the glacier. Bowlders of every shape and size were scattered over the face of the glacier. Large ones were propped up on pinnacles of ice; these were evidently too thick for the sun to heat through. The small bowlders were sunk more or less deeply, and surrounded by water in the hot sun; but they evidently froze fast again at night.

The noise produced by the glacier was startling and strange. One might suppose the mountain was breaking loose, particularly at night. Although, so far as stillness was concerned, there was no difference between day and night, at night the noise seemed more terrible. It was a fearful crashing and grinding that was going on, where the granite was powdered that whitened the river below, and where the bowlders were polished and partially rounded.

The great stillness and solitude were also very oppressive; no familiar sounds; nothing except the whistle of the animal before mentioned and the noise of the glacier's motion was to be heard, and if these had not occurred at intervals the solitude would have been still more oppressive. We were glad to get down again to the Nesqually, where we could hear its roar and see its rushing waters. The other members of the party were so tired and worn, however, that they

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seemed to observe but little, and as we were now on our homeward way, their thoughts were set only on our camp on the Mishawl, with its provisions and promise of rest.

The first day we passed two of the camps we had made coming up, and reached a point where we remembered to have seen a great quantity of blackberries. It was quite dark by the time we reached the little spot of dead timber — which seems to be the favorite haunt of the creeping bramble in this country — and to gather our supper of berries we built a fire at the foot of a large dead tree. Speedily the flames were climbing to the top of the withered branches, and casting a cheerful light for a hundred yards round. But what we found very convenient for gathering berries proved to be a great annoyance when we wanted to sleep. During the night we were constantly moving our place of rest, at first on account of the falling embers, and finally for fear of the tree itself.

Blackberries are refreshing so far as the palate is concerned; but they are not very nourishing. We took our breakfast on them, and continued down the Nesqually from six in the morning until six in the evening, traveling slowly because of the difficult undergrowth and our worn-out and exhausted condition. We passed another of our camps, and finally stopped at what evidently had been an Indian camp. The cedar bark, always to be found in such places, we anticipated would make a shelter for us in case of rain, which the clouds promised us.

No rain fell, however, and we resumed our march, continuing down the river five or six miles farther than where we first struck it, to a point where the hills came close up and overhung the water. There we camped, expecting that an easy march on the morrow would enable us to reach our camp on the Mishawl. We ate our last morsel, and the next morning I was awakened by the conversation of the two soldiers.

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They were evidently discussing the subject of hunger, for the Irishman said: "I've often seen the squaws coming about the cook-house picking the pitaties out of the slop-barrel, an' I thought it was awful; but I giss I'd do it mesilf this mornin'."

The morning of the eleventh day we left the Nesqually to cross over to the Mishawl, and traveled on the mountain all day, until we reached the stream at night completely exhausted. We should have stopped sooner than we did, but we were almost perishing with thirst, not having had any water since we left the Nesqually in the morning. What we took along in our canteens was exhausted in the early part of the day. We were not more than two miles from the camp in the prairie, and notwithstanding that we had had nothing to eat all day, except a few berries we had picked by the way, we were so exhausted that we lay down to sleep as soon as we had quenched our thirst.

We started up-stream the next morning, thinking we had reached the Mishawl below our camp; but soon discovering our mistake, we turned down. At this point the Irishman's heart sunk within him, he was so exhausted. Thinking we were lost, he wanted to lie down in the stream and "drownd" himself. He was assured that we should soon be in camp, and we arrived there very soon after, before the men left in charge of the horses were up.

Our first thought was of something to eat. I cautioned all about eating much at first; but from subsequent results am inclined to think my advice was not heeded. I contented myself with a half cracker, a little butter, and weak coffee; and an hour after, when I began to feel the beneficial effects of what I had eaten, I took a little more substantial meal, but refrained from eating heartily.

After a short rest we caught our horses, and the doctor and I rode into Steilacoom, where we arrived after a hard ride late in the afternoon. As we

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approached the post, we met on the road a number of the inhabitants with whom we were well acquainted, and who did not recognize us. Nor were we surprised when we got a glimpse of our faces in a glass. Haggard and sunburnt, nearly every familiar feature had disappeared. Since the loss of my hat, my head-dress was the sleeve of a red flannel shirt, tied into a knot at the elbow, with the point at the arm-pit for a visor. Our clothes were in rags; one of the doctor's pantaloon-legs had entirely disappeared, and he had improvised a substitute out of a coffee-sack. In our generally dilapidated condition none of our acquaintances recognized us until we got to the post. We passed for Indians until we arrived there, where we were received by the officers with a shout at our ludicrous appearance. They were all sitting under the oak-trees in front of quarters, discussing what had probably become of us, and proposing means for our rescue, when we came up.

I felt the effects of the trip for many days, and did not recover my natural condition for some weeks. The doctor and I went to the village next morning, where the people were startled at our emaciated appearance. We found that the doctor had lost twenty-one pounds in weight in fourteen days, and I had lost fourteen pounds in the same time. The doctor, while we were in the village, was taken with violent pains in his stomach, and returned to his post quite sick. He did not recover his health again for three months.

The two soldiers went into the hospital immediately on their return, and I learned that for the remainder of their service they were in the hospital nearly all the time. Four or five years after, Carroll applied to me for a certificate on which to file an application for a pension, stating that he had not been well since his trip to the mountain. The Indian had an attack of gastritis, and barely escaped with his life after a protracted sickness. I attribute my own escape from a

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lingering illness to the precautions I took in eating when satisfying the first cravings of hunger, on our return to camp.

We are not likely to have any competitors in this attempt to explore the summit of Mount Rainier. Packwood and McAllister, two citizens of Pierce County, Washington Territory, explored up the Nesqually, and crossed over to the head of the Cowlitz River, and thence by what was called Cowlitz Pass (since called Packwood Pass), to the east side of the mountains, searching for a trail to the mining regions of the upper Columbia. More recently, surveyors in the employ of the Pacific Railroad Company have been surveying through the same route for a railway passage.

When the locomotive is heard in that region some day, when American enterprise has established an ice-cream saloon at the foot of the glacier, and sherry-cobblers may be had at twenty-five cents half-way up to the top of the mountain, attempts to ascend that magnificent snow-peak will be quite frequent. But many a long year will pass away before roads are sufficiently good to induce any one to do what we did in the summer of 1857.

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VI. FIRST SUCCESSFUL ASCENT, 1870

By GENERAL HAZARD STEVENS

General Hazard Stevens was born at Newport, Rhode Island, on June 9, 1842. His father was Major General Isaac I. Stevens, and his mother, Margaret (Hazard) Stevens, was a granddaughter of Colonel Daniel Lyman of the Revolution. In 1854 and 1855, while the son was only thirteen years of age, he accompanied his father, then the first governor of Washington Territory, on treaty-making expeditions among the Indian tribes. Later he accompanied his father into the Union Army as an officer on his father's staff. He was severely wounded in the same battle where his father was killed while leading the charge at Chantilly, September 1, 1862.

Hazard Stevens continued in the army, and at the end of the war he was mustered out as a brigadier general of volunteers. He then returned to Washington Territory and went to work to support his mother and sisters. On August 17, 1870, he and P. B. Van Trump made the first successful ascent of Mount Rainier.

In 1874, he followed the other members of the family back to Boston where he remained until his mother's death, a few months ago. He then returned to Puget Sound, and is now a successful farmer near Olympia.

His companion on the ascent, P. B. Van Trump, remained in Washington. For a number of years he was a ranger at Indian Henry's Hunting Ground in the Mount Rainier National Park. There he was a quaint and attractive figure to all visitors. In 1915, he returned East to live among kinsfolk in New York State.

The names of both Stevens and Van Trump have been generously bestowed upon glaciers, creeks, ridges, and cañons within the Mount Rainier National Park.

General Stevens prefers to call the mountain Takhoma. The full account of the ascent was published by him under the title of "The Ascent of Mount Takhoma" in the Atlantic Monthly for November, 1876. It is here reproduced by permission of the editor of that magazine.

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GENERAL HAZARD STEVENS.

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Mr. Van Trump made several ascents after that first one, and in 1905 General Stevens also made a second ascent. He searched in vain for the relics he had deposited at the summit thirty-five years earlier. The rocks that were bare in 1870 were under snow and ice in 1905.

When Vancouver, in 1792, penetrated the Straits of Fuca and explored the unknown waters of the Mediterranean of the Pacific, wherever he sailed, from the Gulf of Georgia to the farthest inlet of Puget Sound, he beheld the lofty, snow-clad barrier range of the Cascades stretching north and south and bounding the eastern horizon. Towering at twice the altitude of all others, at intervals of a hundred miles there loomed up above the range three majestic, snowy peaks that

"Like giants stand
To sentinel enchanted land."

In the matter-of-fact spirit of a British sailor of his time, he named these sublime monuments of nature in honor of three lords of the English admiralty, Hood, Rainier, and Baker. Of these Rainier is the central, situated about half-way between the Columbia River and the line of British Columbia, and is by far the loftiest and largest. Its altitude is 14,444 feet, while Hood is 11,025 feet, and Baker is 10,810 feet high. The others, too, are single cones, while Rainier, or Takhoma,[1] is an immense mountain-mass with three distinct peaks, an eastern, a northern, and a southern; the two last extending out and up from the main central dome, from the summit of which they stand over a mile distant, while they are nearly two miles apart from each other.

Takhoma overlooks Puget Sound from Olympia to Victoria, one hundred and sixty miles. Its snow-clad

[1] Tak-ho'ma or Ta-ho'ma among the Yakimas, Klickitats, Puyallups, Nisquallys, and allied tribes of Indians, is the generic term for mountain, used precisely as we use the word "mount," as Takhoma Wynatchie, or Mount Wynatchie. But they all designate Rainier simply as Takhoma, or The Mountain, just as the mountain men used to call it the "Old He." (Note in the original article.)

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dome is visible from Portland on the Willamette, one hundred and twenty miles south, and from the table-land of Walla Walla, one hundred and fifty miles east. A region two hundred and fifty miles across, including nearly all of Washington Territory, part of Oregon, and part of Idaho, is commanded in one field of vision by this colossus among mountains.

Takhoma had never been ascended. It was a virgin peak. The superstitious fears and traditions of the Indians, as well as the dangers of the ascent, had prevented their attempting to reach the summit, and the failure of a gallant and energetic officer, whose courage and hardihood were abundantly shown during the rebellion, had in general estimation proved it insurmountable.

For two years I had resolved to ascend Takhoma, but both seasons the dense smoke overspreading the whole country had prevented the attempt. Mr. Philomon Beecher Van Trump, humorous, generous, whole-souled, with endurance and experience withal, for he had roughed it in the mines, and a poetic appreciation of the picturesque and the sublime, was equally eager to scale the summit. Mr. Edward T. Coleman, an English gentleman of Victoria, a landscape artist and an Alpine tourist, whose reputed experience in Switzerland had raised a high opinion of his ability above the snow-line, completed the party.

Olympia, the capital of Washington Territory, is a beautiful, maple-embowered town of some two thousand inhabitants, situated at the southernmost extremity of Puget Sound, and west of Takhoma, distant in an air line seventy-five miles. The intervening country is covered with dense fir forests, almost impenetrable to the midday sun, and obstructed with fallen trees, upturned roots and stumps, and a perfect jungle of undergrowth, through which the most energetic traveler can accomplish but eight or nine miles a day. It was advisible to gain the nearest possible point

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by some trail, before plunging into the unbroken forest. The Nisqually River, which rises on the southern and western slopes of Takhoma, and empties into the sound a few miles north of Olympia, offered the most direct and natural approach. Ten years before, moreover, a few enterprising settlers had blazed out a trail across the Cascade Range, which followed the Nisqually nearly up to its source, thence deflected south to the Cowlitz River, and pursued this stream in a northeastern course to the summit of the range, thus turning the great mountain by a wide circuit. The best-informed mountain men represented the approaches on the south and southeast as by far the most favorable. The Nisqually-Cowlitz trail, then, seemed much the best, for the Nisqually, heading in the south and southwest slopes, and the Cowlitz, in the southeastern, afforded two lines of approach, by either of which the distance to the mountain, after leaving the trail, could not exceed thirty miles.

One August afternoon, Van Trump and I drove out to Yelm Prairie, thirty miles east of Olympia, and on the Nisqually River. We dashed rapidly on over a smooth, hard, level road, traversing wide reaches of prairie, passing under open groves of oaks and firs, and plunging through masses of black, dense forest in ever-changing variety. The moon had risen as we emerged upon Yelm Prairie; Takhoma, bathed in cold, white, spectral light from summit to base, appeared startlingly near and distinct. Our admiration was not so noisy as usual. Perhaps a little of dread mingled with it. In another hour we drove nearly across the plain and turned into a lane which conducted us up a beautiful rising plateau, crowned with a noble grove of oaks and overlooking the whole prairie. A comfortable, roomy house with a wide porch nestled among the trees, and its hospitable owner, Mr. James Longmire, appeared at the door and bade us enter.

The next morning we applied to Mr. Longmire for

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a guide, and for his advice as to our proposed trip. He was one of the few who marked out the Nisqually-Cowlitz trail years ago. He had explored the mountains about Takhoma as thoroughly, perhaps, as any other white man. One of the earliest settlers, quiet, self-reliant, sensible, and kindly, a better counselor than he could not have been found. The trail, he said, had not been traveled for four years, and was entirely illegible to eyes not well versed in woodcraft, and it would be folly for any one to attempt to follow it who was not thoroughly acquainted with the country. He could not leave his harvest, and moreover in three weeks he was to cross the mountains for a drove of cattle. His wife, too, quietly discouraged his going. She described his appearance on his return from previous mountain trips, looking as haggard and thin as though he had just risen from a sick-bed. She threw out effective little sketches of toil, discomfort, and hardship incident to mountain travel, and dwelt upon the hard fare. The bountiful country breakfast heaped before us, the rich cream, fresh butter and eggs, snowy, melting biscuits, and broiled chicken, with rich, white gravy, heightened the effect of her words.

But at length, when it appeared that no one else who knew the trail could be found, Mr. Longmire yielded to our persuasions, and consented to conduct us as far as the trail led, and to procure an Indian guide before leaving us to our own resources. As soon as we returned home we went with Mr. Coleman to his room to see a few indispensable equipments he had provided, in order that we might procure similar ones. The floor was literally covered with his traps, and he exhibited them one by one, expatiating upon their various uses. There was his ground-sheet, a large gum blanket equally serviceable to Mr. Coleman as a tent in camp and a bath-tub at the hotel. There was a strong rope to which we were all to be tied when climbing the snow-fields, so that if one fell into a chasm the others could hold him

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up. The "creepers" were a clumsy, heavy arrangement of iron spikes made to fasten on the foot with chains and straps, in order to prevent slipping on the ice. He had an ice-axe for cutting steps, a spirit-lamp for making tea on the mountains, green goggles for snow-blindness, deer's fat for the face, Alpine staffs, needles and thread, twine, tacks, screws, screwdriver, gimlet, file, several medical prescriptions, two boards for pressing flowers, sketching materials, and in fact every article that Mr. Coleman in his extensive reading had found used or recommended by travelers. Every one of these he regarded as indispensable. The Alpine staff was, he declared, most important of all, a great assistance in traveling through the woods as well as on the ice; and he illustrated on his hands and knees how to cross a crevasse in the ice on two staffs. This interview naturally brought to mind the characteristic incident related of Packwood, the mountain man who, as hunter and prospector, had explored the deepest recesses of the Cascades. He had been engaged to guide a railroad surveying party across the mountains, and just as the party was about to start he approached the chief and demanded an advance to enable him to buy his outfit for the trip. "How much do you want?" asked the chief, rather anxiously, lest Packwood should overdraw his prospective wages. "Well, about two dollars and a half," was the reply; and at the camp-fire that evening, being asked if he had bought his outfit, Packwood, thrusting his hand into his pocket, drew forth and exhibited with perfect seriousness and complacency his entire outfit, — a jack-knife and a plug of tobacco.

Half a dozen carriages rattled gayly out of Olympia in the cool of the morning, filled with a laughing, singing, frolicking bevy of young ladies and gentlemen. They were the Takhoma party starting on their adventurous trip, with a chosen escort accompanying them to their first camp. They rested several hours at Longmire's

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during the heat of the day, and the drive was then continued seven miles farther, to the Lacamas, an irregular-shaped prairie two miles in length by half a mile in breadth. Here live two of Mr. Longmire's sons. Their farms form the last settlement, and at the gate of Mr. Elkane Longmire's house the road ends. A wooded knoll overlooking the prairie, with a spring of water at its foot, was selected as the camp-ground. Some of the party stretched a large sail between the trees as a tent, others watered and fed the horses, and others busied themselves with the supper. Two eager sportsmen started after grouse, while their more practical companions bought half a dozen chickens, and had them soon dressed and sputtering over the fire. The shades of night were falling as the party sat down on the ground and partook of a repast fit for the Olympians, and with a relish sharpened by the long journey and a whole day's fast.

Early in the morning Mr. Longmire arrived in camp with two mules and a pack-horse, and our mountain outfit was rapidly made up into suitable bales and packed upon the horse and one of the mules, the other mule being reserved for Longmire's own riding. We assembled around the breakfast with spirits as gay and appetites as sharp as ever. Then, with many good-bys and much waving of handkerchiefs, the party broke up. Four roughly clad pedestrians moved off in single file, leading their pack animals, and looking back at every step to catch the last glimpse of the bright garments and fluttering cambrics, while the carriages drove rapidly down the road and disappeared in the dark, sullen forest.

We stepped off briskly, following a dim trail in an easterly course, and crossing the little prairie entered the timber. After winding over hilly ground for about three miles, we descended into the Nisqually bottom and forded a fine brook at the foot of the hill. For the next ten miles our route lay across the bottom, and along

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the bank of the river, passing around logs, following old, dry beds of the river and its lateral sloughs, ankle-deep in loose sand, and forcing our way through dense jungles of vine-maple. The trail was scarcely visible, and much obstructed by fallen trees and underbrush, and its difficulties were aggravated by the bewildering tracks of Indians who had lately wandered about the bottom in search of berries or rushes. We repeatedly missed the trail, and lost hours in retracing our steps and searching for the right course. The weather was hot and sultry, and rendered more oppressive by the dense foliage; myriads of gnats and mosquitoes tormented us and drove our poor animals almost frantic; and our thirst, aggravated by the severe and unaccustomed toil, seemed quenchless. At length we reached the ford of the Nisqually. Directly opposite, a perpendicular bluff of sand and gravel in alternate strata rose to the height of two hundred and fifty feet, its base washed by the river and its top crowned with firs. The stream was a hundred yards wide, waist-deep, and very rapid. Its waters were icy cold, and of a milk-white hue. This color is the characteristic of glacial rivers. The impalpable powder of thousands of tons of solid rocks ground up beneath the vast weight and resistless though imperceptible flow of huge glaciers, remains in solution in these streams, and colors them milk-white to the sea. Leading the animals down the bank and over a wide, dry bar of cobblestones, we stood at the brink of the swift, turbulent river, and prepared to essay its passage. Coleman mounted behind Van Trump on the little saddle-mule, his long legs dangling nearly to the ground, one hand grasping his Alpine staff, the other the neck-rope of the pack-mule, which Longmire bestrode. Longmire led in turn the pack-horse, behind whose bulky load was perched the other member of the party. The cavalcade, linked together in this order, had but just entered the stream when Coleman dropped the neckrope he was holding. The mule, bewildered

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by the rush and roar of the waters, turned directly down-stream, and in another instant our two pack animals, with their riders, would have been swept away in the furious rapids, had not Longmire with great presence of mind turned their erratic course in the right direction and safely brought them to the opposite shore. Following the bottom along the river for some distance, we climbed up the end of the bluff already mentioned, by a steep zigzag trail, and skirted along its brink for a mile. Far below us on the right rushed the Nisqually. On the left the bluff fell off in a steep hillside thickly clothed with woods and underbrush, and at its foot plowed the Owhap, a large stream emptying into the Nisqually just below our ford. Another mile through the woods brought us out upon the Mishell Prairie, a beautiful, oval meadow of a hundred acres, embowered in the tall, dense fir forest, with a grove of lofty, branching oaks at its farther extremity, and covered with green grass and bright flowers. It takes its name from the Mishell River, which empties into the Nisqually a mile above the prairie.

We had marched sixteen miles. The packs were gladly thrown off beneath a lofty fir; the animals were staked out to graze. A spring in the edge of the woods afforded water, and while Mr. Coleman busied himself with his pipe, his flask, his note-book, his sketch-book, and his pouch of multifarious odds and ends, the other members of the party performed the duties incident to camp-life: made the fire, brought water, spread the blankets, and prepared supper. The flags attached to our Alpine staffs waved gayly overhead, and the sight of their bright folds fluttering in the breeze deepened the fixed resolve to plant them on Takhoma's hoary head, and made failure seem impossible. Mr. Coleman announced the altitude of Mishell Prairie as eight hundred feet by barometer. By an unlucky fall the thermometer was broken.

The march was resumed early next morning. As

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we passed the lofty oaks at the end of the little prairie, "On that tree," said Longmire, pointing out one of the noblest, "Maxon's company hanged two Indians in the war of '56. Ski-hi and his band, after many depredations upon the settlements, were encamped on the Mishell, a mile distant, in fancied security, when Maxon and his men surprised them and cut off every soul except the two prisoners whom they hanged here."

For eight miles the trail led through thick woods, and then, after crossing a wide "burn," past a number of deserted Indian wigwams, where another trail from the Nisqually plains joined ours, it descended a gradual slope, traversed a swampy thicket and another mile of heavy timber, and debouched on the Mishell River. This is a fine, rapid, sparkling stream, knee-deep and forty feet wide, rippling and dashing over a gravelly bed with clear, cold, transparent water. The purity of the clear water, so unlike the yeasty Nisqually, proves that the Mishell is no glacial river. Rising in an outlying range to the northwest of Takhoma, it flows in a southwest course to its confluence with the Nisqually near our previous night's camp. We unsaddled for the noon-rest. Van Trump went up the stream, fishing; Longmire crossed to look out the trail ahead, and Coleman made tea solitaire.

An hour passed, and Longmire returned. "The trail is blind," said he, "and we have no time to lose." Just then Van Trump returned; and the little train was soon in readiness to resume the tramp. Longmire rode his mule across the stream, telling us to drive the pack-animals after him and follow by a convenient log near by. As the mule attempted to climb a low place in the opposite bank, which offered an apparently easy exit from the river, his hind legs sank in a quicksand, he sat down quickly, if not gracefully, and, not fancying that posture, threw himself clear under water. His dripping rider rose to his feet, flung the bridle-rein over his arm, and, springing up the bank at a more practi-

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cable point, strode along the trail with as little delay and as perfect unconcern as though an involuntary ducking was of no more moment than climbing over a log.

The trail was blind. Longmire scented it through thickets of salal, fern, and underbrush, stumbling over roots, vines, and hollows hidden in the rank vegetation, now climbing huge trunks that the animals could barely scramble over, and now laboriously working his way around some fallen giant and traveling two hundred yards in order to gain a dozen yards on the course. The packs, continually jammed against trees and shaken loose by this rough traveling, required frequent repacking — no small task. At the very top of a high, steep hill, up which we had laboriously zigzagged shortly after crossing the Mishell, the little packhorse, unable to sustain the weight of the pack, which had shifted all to one side, fell and rolled over and over to the bottom. Bringing up the goods and chattels one by one on our own shoulders to the top of the hill, we replaced the load and started again. The course was in a southerly direction, over high rolling ground of good clay soil, heavily timbered, with marshy swales at intervals, to the Nisqually River again, a distance of twelve miles. We encamped on a narrow flat between the high hill just descended and the wide and noisy river, near an old ruined log-hut, the former residence of a once famed Indian medicine man, who, after the laudable custom of his race, had expiated with his life his failure to cure a patient.

Early next morning we continued our laborious march along the right bank of the Nisqually. Towards noon we left the river, and after thridding in an easterly course a perfect labyrinth of fallen timber for six miles, and forcing our way with much difficulty through the tangled jungle of an extensive vine-maple swamp, at length crossed Silver Creek and gladly threw off the packs for an hour's rest.

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A short distance after crossing Silver Creek the trail emerged upon more open ground, and for the first time the Nisqually Valley lay spread out in view before us. On the left stretched a wall of steep, rocky mountains, standing parallel to the course of the river and extending far eastward, growing higher and steeper and more rugged as it receded from view. At the very extremity of this range Takhoma loomed aloft, its dome high above all others and its flanks extending far down into the valley, and all covered, dome and flanks, with snow of dazzling white, in striking contrast with the black basaltic mountains about it. Startlingly near it looked to our eyes, accustomed to the restricted views and gloom of the forest.

After our noon rest we continued our journey up the valley, twisting in and out among the numerous trunks of trees that encumbered the ground, and after several hours of tedious trudging struck our third camp on Copper Creek, the twin brother to Silver Creek, just at dusk. We were thoroughly tired, having made twenty miles in thirteen hours of hard traveling.

Starting at daylight next morning, we walked two miles over rough ground much broken by ravines, and then descended into the bed of the Nisqually at the mouth of Goat Creek, another fine stream which empties here. We continued our course along the river bed, stumbling over rocky bars and forcing our way through dense thickets of willow, for some distance, then ascended the steep bank, went around a high hill over four miles of execrable trail, and descended to the river again, only two miles above Goat Creek. At this point the Takhoma branch or North Fork joins the Nisqually. This stream rises on the west side of Takhoma, is nearly as large as the main river, and like it shows its glacial origin by its milk-white water and by its icy cold, terribly swift and furious torrent. Crossing the Takhoma branch, here thirty yards wide, we kept up the main river, crossing and

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recrossing the stream frequently, and toiling over rocky bars for four miles, a distance which consumed five hours, owing to the difficulties of the way. We then left the Nisqually, turning to the right and traveling in a southerly course, and followed up the bed of a swampy creek for half a mile, then crossed a level tract much obstructed with fallen timber, then ascended a burnt ridge, and followed it for two miles to a small, marshy prairie in a wide canyon or defile closed in by rugged mountains on either side, and camped beside a little rivulet on the east side of the prairie. This was Bear Prairie, the altitude of which by the barometer was 2630 feet. The canyon formed a low pass between the Nisqually and Cowlitz rivers, and the little rivulet near which we camped flowed into the latter stream. The whole region had been swept by fire: thousands of giant trunks stook blackened and lifeless, the picture of desolation.

As we were reclining on the ground around the campfire, enjoying the calm and beatific repose which comes to the toil-worn mountaineer after his hearty supper, one of these huge trunks, after several warning creaks, came toppling and falling directly over our camp. All rushed to one side or another to avoid the impending crash. As one member of the party, hastily catching up in one hand a frying-pan laden with tin plates and cups, and in the other the camp kettle half full of boiling water, was scrambling away, his foot tripped in a blackberry vine and he fell outstretched at full length, the much-prized utensils scattering far and wide, while the falling tree came thundering down in the rear, doing no other damage, however, than burying a pair of blankets.

The following day Longmire and the writer went down the canyon to its junction with the Cowlitz River, in search of a band of Indians who usually made their headquarters at this point, and among whom Longmire hoped to find some hunter familiar with the

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mountains who might guide us to the base of Takhoma. The tiny rivulet as we descended soon swelled to a large and furious torrent, and its bed filled nearly the whole bottom of the gorge. The mountains rose on both sides precipitously, and the traces of land-slides which had gouged vast furrows down their sides were frequent. With extreme toil and difficulty we made our way, continually wading the torrent, clambering over broken masses of rock which filled its bed, or clinging to the steep hillsides, and reached the Cowlitz at length after twelve miles of this fatiguing work, but only to find the Indian camp deserted. Further search, however, was rewarded by the discovery of a rude shelter formed of a few skins thrown over a framework of poles, beneath which sat a squaw at work upon a half-dressed deerskin. An infant and a naked child of perhaps four years lay on the ground near the fire in front. Beside the lodge and quietly watching our approach, of which he alone seemed aware, stood a tall, slender Indian clad in buckskin shirt and leggings, with a striped woolen breech-clout, and a singular head garniture which gave him a fierce and martial appearance. This consisted of an old military cap, the visor thickly studded with brassheaded nails, while a large circular brass article, which might have been the top of an oil-lamp, was fastened upon the crown. Several eagle feathers stuck in the crown and strips of fur sewed upon the sides completed the edifice, which, notwithstanding its components, appeared imposing rather than ridiculous. A long Hudson Bay gun, the stock also ornamented with brass-headed tacks, lay in the hollow of the Indian's shoulder.

He received us with great friendliness, yet not without dignity, shaking hands and motioning us to a seat beneath the rude shelter, while his squaw hastened to place before us suspicious-looking cakes of dried berries, apparently their only food. After a moderate indulgence in this delicacy, Longmire made known our

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wants. The Indian spoke fluently the Chinook jargon, that high-bred lingo invented by the old fur-traders. He called himself "Sluiskin," and readily agreed to guide us to Rainier, known to him only as Takhoma, and promised to report at Bear Prairie the next day. It was after seven in the evening when we reached camp, thoroughly fagged.

Punctual to promise, Sluiskin rode up at noon mounted upon a stunted Indian pony, while his squaw and pappooses followed upon another even more puny and forlorn. After devouring an enormous dinner, evidently compensating for the rigors of a long fast, in reply to our inquiries he described the route he proposed to take to Takhoma. Pointing to the almost perpendicular height immediately back or east of our camp, towering three thousand feet or more overhead, the loftiest mountain in sight, "We go to the top of that mountain to-day," said he, "and to-morrow we follow along the high, backbone ridge of the mountains, now up, now down, first on one side and then on the other, a long day's journey, and at last, descending far down from the mountains into a deep valley, reach the base of Takhoma." Sluiskin illustrated his Chinook with speaking signs and pantomine. He had frequently hunted the mountain sheep upon the snow-fields of Takhoma, but had never ascended to the summit. It was impossible to do so, and he put aside as idle talk our expressed intention of making the ascent.

We had already selected the indispensable articles for a week's tramp, a blanket apiece, the smallest coffee-pot and frying-pan, a scanty supply of bacon, flour, coffee, etc., and had made them up into suitable packs of forty pounds each, provided with slings like a knapsack, and had piled together under the lee of a huge fallen trunk our remaining goods. Longmire, who although impatient to return home, where his presence was urgently needed, had watched and directed our preparations during the forenoon with kindly solicitude,

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now bade us good-by: mounted on one mule and leading the other, he soon disappeared down the trail on his lonely, homeward way. He left us the little pack-horse, thinking it would be quite capable of carrying our diminished outfit after our return from Takhoma.

Sluiskin led the way. The load upon his shoulders was sustained by a broad band, passing over his head, upon which his heavy, brass-studded rifle, clasped in both hands, was poised and balanced. Leaving behind the last vestige of trail, we toiled in single file slowly and laboriously up the mountain all the afternoon. The steepness of the ascent in many places required the use of both hand and foot in climbing, and the exercise of great caution to keep the heavy packs from dragging us over backwards. Coleman lagged behind from the start, and at intervals his voice could be heard hallooing and calling upon us to wait. Towards sunset we reached a level terrace, or bench, near the summit, gladly threw off our packs, and waited for Coleman, who, we supposed, could not be far below. He not appearing, we hallooed again and again. No answer! We then sent Sluiskin down the mountain to his aid. After an hour's absence the Indian returned. He had descended, he said, a long distance, and at last caught sight of Coleman. He was near the foot of the mountain, had thrown away his pack, blankets and all, and was evidently returning to camp. And Sluiskin finished his account with expressions of contempt for the "cultus King George man." What was to be done? Coleman carried in his pack all our bacon, our only supply of meat, except a few pounds of dried beef. He also had the barometer, the only instrument that had survived the jolts and tumbles of our rough trip. But, on the other hand, he had been a clog upon our march from the outset. He was evidently too infirm to endure the toil before us, and would not only be unable to reach, still less ascend Takhoma, but might even

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impede and frustrate our own efforts. Knowing that he would be safe in camp until our return, we hastily concluded to proceed without him, trusting to our rifles for a supply of meat.

Sluiskin led us along the side of the ridge in a southerly direction for two miles farther, to a well-sheltered, grassy hollow in the mountain-top, where he had often previously encamped. It was after dark when we reached this place. The usual spring had gone dry, and, parched with thirst we searched the gulches of the mountain-side for water an hour, but without success. At length the writer, recalling a scanty rill which trickled across their path a mile back, taking the coffee-pot and large canteen, retraced his steps, succeeded in filling these utensils after much fumbling in the dark and consequent delay, and returned to camp. He found Van Trump and the Indian, anxious at the long delay, mounted on the crest of the ridge some two hundred yards from camp, waving torches and shouting lustily to direct his steps. The mosquitoes and flies came in clouds, and were terribly annoying. After supper of coffee and bread, we drank up the water, rolled ourselves in our blankets, and lay down under a tree with our flags floating from under the boughs overhead. Hot as had been the day, the night was cold and frosty, owing, doubtless, to the altitude of our camp.

At the earliest dawn next morning we were moving on without breakfast, and parched with thirst. Sluiskin led us in a general course about north-northeast, but twisting to nearly every point of the compass, and climbing up and down thousands of feet from mountain to mountain, yet keeping on the highest backbone between the headwaters of the Nisqually and Cowlitz rivers. After several hours of this work we came to a well-sheltered hollow, one side filled with a broad bed of snow, at the foot of which nestled a tiny, tranquil lakelet, and gladly threw off our heavy packs, assuaged our thirst, and took breakfast, — bread and coffee

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again. Early as it was, the chill of the frosty night still in the air, the mosquitoes renewed their attacks, and proved as innumerable and vexatious as ever.

Continuing our march, we crossed many beds of snow, and drank again and again from the icy rills which flowed out of them. The mountains were covered with stunted mountain-ash and low, stubby firs with short, bushy branches, and occasionally a few pines. Many slopes were destitute of trees but covered with luxuriant grass and the greatest profusion of beautiful flowers of vivid hues. This was especially the case with the southern slopes, while the northern sides of the mountains were generally wooded. We repeatedly ate berries, and an hour afterwards ascended to where berries of the same kind were found scarcely yet formed. The country was much obscured with smoke from heavy fires which had been raging on the Cowlitz the last two days. But when at length, after climbing for hours an almost perpendicular peak, — creeping on hands and knees over loose rocks, and clinging to scanty tufts of grass where a single slip would have sent us rolling a thousand feet down to destruction, — we reached the highest crest and looked over, we exclaimed that we were already well repaid for all our toil. Nothing can convey an idea of the grandeur and ruggedness of the mountains. Directly in front, and apparently not over two miles distant, although really twenty, old Takhoma loomed up more gigantic than ever. We were far above the level of the lower snow-line on Takhoma. The high peak upon which we clung seemed the central core or focus of all the mountains around, and on every side we looked down vertically thousands of feet, deep down into vast, terrible defiles, black and fir-clothed, which stretched away until lost in the distance and smoke. Between them, separating one from another, the mountain-walls rose precipitously and terminated in bare, columnar peaks of black basaltic or volcanic rock, as sharp as needles. It seemed incredible that any

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human foot could have followed out the course we came, as we looked back upon it.

After a few hours more of this climbing, we stood upon the summit of the last mountain-ridge that separated us from Takhoma. We were in a saddle of the ridge; a lofty peak rose on either side. Below us extended a long, steep hollow or gulch filled with snow, the farther extremity of which seemed to drop off perpendicularly into a deep valley or basin. Across this valley, directly in front, filling up the whole horizon and view with an indescribable aspect of magnitude and grandeur, stood the old leviathan of mountains. The broad, snowy dome rose far among and above the clouds. The sides fell off in vertical steeps and fearful black walls of rock for a third of its altitude; lower down, vast, broad, gently sloping snow-fields surrounded the mountain, and were broken here and there by ledges or masses of the dark basaltic rock protruding above them. Long, green ridges projected from this snow-belt at intervals, radiating from the mountain and extending many miles until lost in the distant forests. Deep valleys lay between these ridges. Each at its upper end formed the bed of a glacier, which closed and filled it up with solid ice. Below the snow-line bright green grass with countless flowers, whose vivid scarlet, blue, and purple formed bodies of color in the distance, clothed the whole region of ridges and valleys, for a breadth of five miles. The beautiful balsam firs, about thirty feet in height, and of a purple, dark-green color, stood scattered over the landscape, now singly, now in groves, and now in long lines, as though planted in some well-kept park. Farther down an unbroken fir forest surrounded the mountain and clad the lower portions of the ridges and valleys. In every sheltered depression or hollow lay beds of snow with tiny brooks and rivulets flowing from them. The glaciers terminated not gradually, but abruptly, with a wall of ice from one to five hundred feet high, from be-

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neath which yeasty torrents burst forth and rushed roaring and tumbling down the valleys. The principal of these, far away on our left front, could be seen plunging over two considerable falls, half hidden in the forest, while the roar of waters was distinctly audible.

At length we cautiously descended the snow-bed, and, climbing at least fifteen hundred feet down a steep but ancient land-slide by means of the bushes growing among the loose rocks, reached the valley, and encountered a beautiful, peaceful, limpid creek. Van Trump could not resist the temptation of unpacking his bundle, selecting one of his carefully preserved flies, and trying the stream for trout, but without a single rise. After an hour's rest and a hearty repast we resumed our packs, despite Sluiskin's protests, who seemed tired out with his arduous day's toil and pleaded hard against traveling farther. Crossing the stream, we walked through several grassy glades, or meadows, alternating with open woods. We soon came to the foot of one of the long ridges already described, and ascending it followed it for several miles through open woods, until we emerged upon the enchanting emerald and flowery meads which clothe these upper regions. Halting upon a rising eminence in our course, and looking back, we beheld the ridge of mountains we had just descended stretching from east to west in a steep, rocky wall; a little to the left, a beautiful lake, evidently the source of the stream just crossed, which we called Clear Creek, and glimpses of which could be seen among the trees as it flowed away to the right, down a rapidly descending valley along the foot of the lofty mountain-wall. Beyond the lake again, still farther to the left, the land also subsided quickly. It was at once evident that the lake was upon a summit, or divide, between the waters of the Nisqually and Cowlitz rivers. The ridge which we were ascending lay north and south, and led directly up to the mountain.

We camped, as the twilight fell upon us, in an aro-

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matic grove of balsam firs. A grouse, the fruit of Sluiskin's rifle, broiled before the fire, and impartially divided gave a relish to the dry bread and coffee. After supper we reclined upon our blankets in front of the bright, blazing fire, well satisfied. The Indian, when starting from Bear Prairie, had evidently deemed our intention of ascending Takhoma too absurd to deserve notice. The turning back of Mr. Coleman only deepened his contempt for our prowess. But his views had undergone a change with the day's march. The affair began to look serious to him, and now in Chinook, interspersed with a few words of broken English and many signs and gesticulations, he began a solemn exhortation and warning against our rash project.

Takhoma, he said, was an enchanted mountain, inhabited by an evil spirit, who dwelt in a fiery lake on its summit. No human being could ascend it or even attempt its ascent, and survive. At first, indeed, the way was easy. The broad snow-fields, over which he had so often hunted the mountain goat, interposed no obstacle, but above them the rash adventurer would be compelled to climb up steeps of loose, rolling rocks, which would turn beneath his feet and cast him headlong into the deep abyss below. The upper snow-slopes, too, were so steep that not even a goat, far less a man, could get over them. And he would have to pass below lofty walls and precipices whence avalanches of snow and vast masses of rocks were continually falling; and these would inevitably bury the intruder beneath their ruins. Moreover, a furious tempest continually swept the crown of the mountain, and the luckless adventurer, even if he wonderfully escaped the perils below, would be torn from the mountain and whirled through the air by this fearful blast. And the awful being upon the summit, who would surely punish the sacrilegious attempt to invade his sanctuary, — who could hope to escape his vengeance? Many years ago, he continued, his grandfather, a great chief

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and warrior, and a mighty hunter, had ascended part way up the mountain, and had encountered some of these dangers, but he fortunately turned back in time to escape destruction; and no other Indian had ever gone so far.

Finding that his words did not produce the desired effect, he assured us that, if we persisted in attempting the ascent, he would wait three days for our return, and would then proceed to Olympia and inform our friends of our death; and he begged us to give him a paper (a written note) to take to them, so that they might believe his story. Sluiskin's manner during this harangue was earnest in the extreme, and he was undoubtedly sincere in his forebodings. After we had retired to rest, he kept up a most dismal chant, or dirge, until late in the night. The dim, white, spectral mass towering so near, the roar of the torrents below us, and the occasional thunder of avalanches, several of which fell during the night, added to the weird effect of Sluiskin's song.

The next morning we moved two miles farther up the ridge and made camp in the last clump of trees, quite within the limit of perpetual snow. Thence, with snow-spikes upon our feet and Alpine staff in hand, we went up the snow-fields to reconnoiter the best line of ascent. We spent four hours, walking fast, in reaching the foot of the steep, abrupt part of the mountain. After carefully scanning the southern approaches, we decided to ascend on the morrow by a steep, rocky ridge that seemed to lead up to the snowy crown.

Our camp was pitched on a high knoll crowned by a grove of balsam firs, near a turbulent glacial torrent. About nine o'clock, after we had lain down for the night, the firs round our camp took fire and suddenly burst out in a vivid conflagration. The night was dark and windy, and the scene — the vast, dim outlines of Takhoma, the white snow-fields, the roaring torrent, the crackling blaze of the burning trees — was strikingly wild and picturesque.

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In honor of our guide we named the cascade at our feet Sluiskin's Falls; the stream we named Glacier Creek, and the mass of ice whence it derives its source we styled the Little Nisqually Glacier.

Before daylight the next morning, Wednesday, August 17, 1870, we were up and had breakfasted, and at six o'clock we started to ascend Takhoma. Besides our Alpine staffs and creepers, we carried a long rope, and ice-axe, a brass plate inscribed with our names, our flags, a large canteen, and some luncheon. We were also provided with gloves, and green goggles for snow-blindness, but found no occasion to use the latter. Having suffered much from the heat of the sun since leaving Bear Prairie, and being satisfied from our late reconnoissance that we could reach the summit and return on the same day, we left behind our coats and blankets. In three hours of fast walking we reached the highest point of the preceding day's trip, and commenced the ascent by the steep, rocky ridge already described as reaching up to the snowy dome. We found it to be a very narrow, steep, irregular backbone, being solid rock, while the sides were composed of loose broken rocks and débris. Up this ridge, keeping upon the spine when possible, and sometimes forced to pick our way over the loose and broken rocks at the sides, around columnar masses which we could not directly climb over, we toiled for five hundred yards, ascending at an angle of nearly forty-five degrees. Here the ridge connected, by a narrow neck or saddle, with a vast square rock, whose huge and distinct outline can be clearly perceived from a distance of twenty-five miles. This, like the ridge, is a conglomerate of basalt and trap, in well-defined strata, and is rapidly disintegrating and continually falling in showers and even masses of rocks and rubbish, under the action of frost by night and melting snow by day. It lies imbedded in the side of the mountain, with one side and end projected and overhanging deep, terrible gorges,

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and it is at the corner or junction of these two faces that the ridge joined it at a point about a thousand feet below its top. On the southern face the strata were inclined at an angle of thirty degrees. Crossing by the saddle from the ridge, despite a strong wind which swept across it, we gained a narrow ledge formed by a stratum more solid than its fellows, and creeping along it, hugging close to the main rock on our right, laboriously and cautiously continued the ascent. The wind was blowing violently. We were now crawling along the face of the precipice almost in mid-air. On the right the rock towered far above us perpendicularly. On the left it fell sheer off, two thousand feet, into a vast abyss. A great glacier filled its bed and stretched away for several miles, all seamed or wrinkled across with countless crevasses. We crept up and along a ledge, not of solid, sure rock, but one obstructed with the loose stones and débris which were continually falling from above, and we trod on the upper edge of a steep slope of this rubbish, sending the stones at every step rolling and bounding into the depth below. Several times during our progress showers of rocks fell from the precipice above across our path, and rolled into the abyss, but fortunately none struck us.

Four hundred yards of this progress brought us to where the rock joined the overhanging edge of the vast névé or snow-field that descended from the dome of the mountain and was from time to time, as pressed forward and downward, breaking off in immense masses, which fell with a noise as of thunder into the great canyon on our left. The junction of rock and ice afforded our only line of ascent. It was an almost perpendicular gutter, but here our ice-axe came into play, and by cutting steps in the ice and availing ourselves of every crevice or projecting point of the rock, we slowly worked our way up two hundred yards higher. Falling stones were continually coming down, both from the rock on our right and from the ice in

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front, as it melted and relaxed its hold upon them. Mr. Van Trump was hit by a small one, and another struck his staff from his hands. Abandoning the rock, then, at the earliest practicable point, we ascended directly up the ice, cutting steps for a short distance, until we reached ice so corrugated, or drawn up in sharp pinnacles, as to afford a foothold. These folds or pinnacles were about two or three feet high, and half as thick, and stood close together. It was like a very violent chop sea, only the waves were sharper. Up this safe footing we climbed rapidly, the side of the mountain becoming less and less steep, and the ice waves smaller and more regular, and, after ascending about three hundred yards, stood fairly upon the broad dome of mighty Takhoma. It rose before us like a broad, gently swelling headland of dazzling white, topped with black, where the rocky summit projected above the névé. Ascending diagonally towards the left, we continued our course. The snow was hard and firm under foot, crisp and light for an inch or two, but solidified into ice a foot or less beneath the surface. The whole field was covered with the ice-waves already described, and intersected by a number of crevasses which we crossed at narrow places without difficulty. About half-way up the slope, we encountered one from eight to twenty feet wide and of profound depth. The most beautiful vivid emerald-green color seemed to fill the abyss, the reflection of the bright sunlight from side to side of its pure ice walls. The upper side or wall of the crevasse was some twelve feet above the lower, and in places overhung it, as though the snow-field on the lower side had bodily settled down a dozen feet. Throwing a bight of the rope around a projecting pinnacle on the upper side, we climbed up, hand over hand, and thus effected a crossing. We were now obliged to travel slowly, with frequent rests. In that rare atmosphere, after taking seventy or eighty steps, our breath would be gone, our muscles grew tired and strained, and we experienced all

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the sensations of extreme fatigue. An instant's pause, however, was sufficient to recover strength and breath, and we would start again. The wind, which we had not felt while climbing the steepest part of the mountain, now again blew furiously, and we began to suffer from the cold. Our course, — directed still diagonally towards the left, thus shunning the severe exertion of climbing straight up the dome, although at an ordinary altitude the slope would be deemed easy, — brought us first to the southwest peak. This is a long, exceedingly sharp, narrow ridge, springing out from the main dome for a mile into mid-air. The ridge affords not over ten or twelve feet of foothold on top, and the sides descend almost vertically. On the right side the snow lay firm and smooth for a few feet on top, and then descended in a steep, unbroken sheet, like an immense, flowing curtain, into the tremendous basin which lies on the west side of the mountain between the southern and northern peaks, and which is inclosed by them as by two mighty arms. The snow on the top and left crest of the ridge was broken into high, sharp pinnacles, with cracks and fissures extending to the rocks a few feet below. The left side, too steep for the snow to lie on, was vertical, bare rock. The wind blew so violently that we were obliged to brace ourselves with our Alpine staffs and use great caution to guard against being swept off the ridge. We threw ourselves behind the pinnacles or into the cracks every seventy steps, for rest and shelter against the bitter, piercing wind. Hastening forward in this way along the dizzy, narrow, and precarious ridge, we reached at length the highest point. Sheltered behind a pinnacle of ice we rested a moment, took out our flags and fastened them upon the Alpine staffs, and then, standing erect in the furious blast, waved them in triumph with three cheers. We stood a moment upon that narrow summit, bracing ourselves against the tempest to view the prospect. The whole country was shrouded in a dense sea of

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smoke, above which the mountain towered two thousand feet in the clear, cloudless ether. A solitary peak far to the southeast, doubtless Mount Adams, and one or two others in the extreme northern horizon, alone protruded above the pall. On every side of the mountain were deep gorges falling off precipitously thousands of feet, and from these the thunderous sound of avalanches would rise occasionally. Far below were the wide-extended glaciers already described. The wind was now a perfect tempest, and bitterly cold; smoke and mist were flying about the base of the mountian, half hiding, half revealing its gigantic outlines; and the whole scene was sublimely awful.

It was now five P.M. We had spent eleven hours of unremitted toil in making the ascent, and, thoroughly fatigued, and chilled by the cold, bitter gale, we saw ourselves obliged to pass the night on the summit without shelter or food, except our meagre lunch. It would have been impossible to descend the mountain before nightfall, and sure destruction to attempt it in darkness. We concluded to return to a mass of rocks not far below, and there pass the night as best we could, burrowing in the loose débris.

The middle peak of the mountain, however, was evidently the highest, and we determined to first visit it. Retracing our steps along the narrow crest of Peak Success, as we named the scene of our triumph, we crossed an intervening depression in the dome, and ascended the middle peak, about a mile distant and two hundred feet higher than Peak Success. Climbing over a rocky ridge which crowns the summit, we found ourselves within a circular crater two hundred yards in diameter, filled with a solid bed of snow, and inclosed with a rim of rocks projecting above the snow all around. As we were crossing the crater on the snow, Van Trump detected the odor of sulphur, and the next instant numerous jets of steam and smoke were observed issuing from the crevices of the rocks which formed the rim on

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the northern side. Never was a discovery more welcome! Hastening forward, we both exclaimed, as we warmed our chilled and benumbed extremities over one of Pluto's fires, that here we would pass the night, secure against freezing to death, at least. These jets were from the size of that of a large steampipe to a faint, scarcely perceptible emission, and issued all along the rim among the loose rocks on the northern side for more than half the circumference of the crater. At intervals they would puff up more strongly, and the smoke would collect in a cloud until blown aside and scattered by the wind, and then their force would abate for a time.

A deep cavern, extending into and under the ice, and formed by the action of heat, was found. Its roof was a dome of brilliant green ice with long icicles pendent from it, while its floor, composed of the rocks and débris which formed the side of the crater, descended at an angle of thirty degrees. Forty feet within its mouth we built a wall of stones, inclosing a space five by six feet around a strong jet of steam and heat. Unlike the angular, broken rocks met with elsewhere, within the crater we found well-rounded bowlders and stones of all sizes worn as smooth by the trituration of the crater as by the action of water. Nowhere, however, did we observe any new lava or other evidences of recent volcanic action excepting these issues of steam and smoke. Inclosed within the rude shelter thus hastily constructed, we discussed our future prospects while we ate our lunch and warmed ourselves at our natural register. The heat at the orifice was too great to bear for more than an instant, but the steam wet us, the smell of sulphur was nauseating, and the cold was so severe that our clothes, saturated with the steam, froze stiff when turned away from the heated jet. The wind outside roared and whistled, but it did not much affect us, secure within our cavern, except when an occasional gust came down perpendicularly. However,

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we passed a most miserable night, freezing on one side, and in a hot steam-sulphur-bath on the other.

The dawn at last slowly broke, cold and gray. The tempest howled still wilder. As it grew light, dense masses of driven mist went sweeping by overhead and completely hid the sun, and enveloped the mountain so as to conceal objects scarce a hundred feet distant. We watched and waited with great anxiety, fearing a storm which might detain us there for days without food or shelter, or, worse yet, snow, which would render the descent more perilous, or most likely impossible. And when, at nine A.M., an occasional rift in the driving mist gave a glimpse of blue sky, we made haste to descend. First, however, I deposited the brass plate inscribed with our names in a cleft in a large bowlder on the highest summit, — a huge mount of rocks on the east side of our crater of refuge, which we named Crater Peak, — placed the canteen alongside, and covered it with a large stone. I was then literally freezing in the cold, piercing blast, and was glad to hurry back to the crater, breathless and benumbed.

We left our den of refuge at length, after exercising violently to start the blood through our limbs, and, in attempting to pass around the rocky summit, discovered a second crater, larger than the first, perhaps three hundred yards in diameter. It is circular, filled with a bed of snow, with a rocky rim all around and numerous jets of steam issuing from the rocks on the northern side. Both craters are inclined — the first to the west, and the latter to the east with a much steeper inclination, about thirty degrees. The rim of the second crater is higher, or the snow-field inside lower, than that of the first, and upon the east side rises in a rocky wall thirty feet above the snow within. From the summit we obtained a view of the northern peak, still partially enveloped in the driving mist. It appeared about a mile distant, several hundred feet lower than the center peak, and separated from it by a deeper,

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more abrupt depression or gap than that separating Crater and Success peaks. Like the latter, too, it is a sharp, narrow ridge springing out from the main mountain, and swept bare of snow on its summit by the wind. The weather was still too threatening, the glimpses of the sun and sky through the thick, flying scud were too few and fugitive, to warrant us in visiting this peak, which we named Peak Takhoma, to perpetuate the Indian name of the mountain.

Our route back was the same as on the ascent. At the steepest and most perilous point in descending the steep gutter where we had been forced to cut steps in the ice, we fastened one end of the rope as securely as possible to a projecting rock, and lowered ourselves down by it as far as it reached, thereby passing the place with comparative safety. We were forced to abandon the rope here, having no means of unfastening it from the rock above. We reached the foot of the rocky ledge or ridge, where the real difficulties and dangers of the ascent commenced, at 1.30 P.M., four and a half hours after leaving the crater. We had been seven and a half hours in ascending from this point to the summit of Peak Success, and in both cases we toiled hard and lost no time.

We now struck out rapidly and joyfully for camp. When nearly there Van Trump, in attempting to descend a snowbank without his creepers, which he had taken off for greater ease in walking, fell, shot like lightning forty feet down the steep incline, and struck among some loose rocks at its foot with such force as to rebound several feet into the air; his face and hands were badly skinned, and he received some severe bruises and a deep, wide gash upon his thigh. Fortunately the camp was not far distant, and thither with great pain and very slowly he managed to hobble. Once there I soon started a blazing fire, made coffee, and roasted choice morsels of a marmot, Sluiskin having killed and dressed four of these animals during

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our absence. Their flesh, like the badger's, is extremely muscular and tough, and has a strong, disagreeable, doggy odor.

Towards the close of our repast, we observed the Indian approaching with his head down, and walking slowly and wearily as though tired by a long tramp. He raised his head as he came nearer, and, seeing us for the first time, stopped short, gazed long and fixedly, and then slowly drew near, eying us closely the while, as if to see whether we were real flesh and blood or disembodied ghosts fresh from the evil demon of Takhoma. He seemed both astonished and delighted to find us safe back, and kept repeating that we were strong men and had brave hearts: "Skookum tilicum, skookum tumtum." He expected never to see us again, he said, and had resolved to start the next morning for Olympia to report our destruction.

The weather was still raw and cold. A dense cloud overhung and shrouded the triple crown of Takhoma and made us rejoice at our timely descent. The scanty shelter afforded by the few balsam firs about our camp had been destroyed by the fire, and the situation was terribly exposed to the chilly and piercing wind that blew from the great ice-fields. Van Trump, however, was too badly hurt to think of moving that night. Heating some large stones we placed them at our feet, and closely wrapped in our blankets slept soundly upon the open ground, although we awoke in the morning benumbed and chilled.

We found many fresh tracks and signs of the mountain-sheep upon the snowfields, and hair and wool rubbed off upon rocks, and places where they had lain at night. The mountain-sheep of Takhoma is much larger than the common goat, and is found only upon the loftiest and most secluded peaks of the Cascade Range. Even Sluiskin, a skillful hunter and accustomed to the pursuit of this animal for years, failed to kill one, notwithstanding he hunted assiduously during

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our entire stay upon the mountain, three days. Sluiskin was greatly chagrined at his failure, and promised to bring each of us a sheep-skin the following summer, a promise which he faithfully fulfilled.

The glacial system of Takhoma is stupendous. The mountain is really the focal centre and summit of a region larger than Massachusetts, and the five large rivers which water this region all find their sources in its vast glaciers. They are the Cowlitz, which empties into the Columbia; the White, Puyallup, and Nisqually rivers, which empty into Puget Sound sixty, forty, and twelve miles respectively north of Olympia; and the Wenass, which flows eastward through the range and empties into the Yakima, which joins the Columbia four hundred miles above its mouth. These are all large streams from seventy to a hundred miles in length. The White, Puyallup, and Cowlitz rivers are each navigable for steamboats for some thirty miles, and like the Nisqually show their glacial origin by their white and turgid water, which indeed gives the former its name.

The southwestern sides of the mountain furnish the glaciers which form the sources of the Nisqually, and one of these, at Sluiskin's Falls, has been already described. The main Nisqually glacier issues from the deep abyss overhung by the vast rock along the face of which our route of ascent lay, and extends in a narrow and somewhat crooked canyon for two miles. The ice at its extremity rises in an abrupt wall five hundred feet high, and a noisy torrent pours out with great force from beneath. This feature is characteristic of every glacier. The main Cowlitz glacier issues from the southeast side, just to the right of our ridge of ascent. Its head fills a deep gorge at the foot of the eastern front or face of the great mass of rock just referred to, and the southern face of which overhangs the main Nisqually glacier. Thus the heads of these glaciers are separated only by this great rock, and are probably not

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more than half a mile apart, while their mouths are three miles apart. Several smaller glaciers serve to swell the waters of the Cowlitz. In like manner the glaciers from the western side form the Puyallup, and those from the northern and northwestern sides the White River. The principal White River glacier is nearly ten miles long, and its width is from two to four miles. Its depth, or the thickness of its ice, must be thousands of feet. Streams and rivulets under the heat of the sun flow down its surface until swallowed by the crevasses, and a lakelet of deep blue water an eighth of a mile in diameter has been observed upon the solid ice. Pouring down from the mountain, the ice by its immense weight and force has gouged out a mass upon the northeastern side a mile in thickness. The geological formation of Takhoma poorly resists the eroding power of these mighty glaciers, for it seems to be composed not of solid rock, but of a basaltic conglomerate in strata, as though the volcanic force had burst through and rent in pieces some earlier basaltic outflow, and had heaped up this vast pile from the fragments in successive strata. On every side the mountain is slowly disintegrating.

What other peak can offer to scientific examination or to the admiration of tourists fourteen living glaciers of such magnitude, issuing from every side, or such grandeur, beauty, and variety of scenery?

At daylight we broke up our camp at Sluiskin's Falls, and moved slowly, on account of Van Trump's hurt, down the ridge about five miles to Clear Creek, where we again regaled ourselves upon a hearty repast of marmots, or "raw dog," as Van Trump styled them in derision both of the viand and of the cookery. I was convinced from the lay of the country that Clear Creek flowed into the Nisqually, or was, perhaps, the main stream itself, and that the most direct and feasible route back to Bear Prairie would be found by following down the valley of these streams to the trail leading from

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the Nisqually to Bear Prairie. Besides, it was evidently impossible for Van Trump, in his bruised and injured state, to retrace our rough route over the mountains. Leaving him as comfortable as possible, with all our scanty stock of flour and marmots, sufficient to last him nearly a week in case of need, I started immediately after dinner, with Sluiskin leading the way, to explore this new route. The Indian had opposed the attempt strenuously, insisting with much urgency that the stream flowed through canyons impossible for us to traverse. He now gradually veered away from the course of the stream, until ere-long he was leading directly up the steep mountain range upon our former route, when I called him back peremptorily, and kept him in the rear for a little distance. Traveling through open timber, over ground rapidly descending, we came at the end of two miles to where the stream is hemmed in between one of the long ridges or spurs from Takhoma and the high mountain-chain on the south. The stream, receiving many affluents on both sides, its clear waters soon discolored by the yeasty glacial torrents, here loses its peaceful flow, and for upwards of three miles rushes furiously down a narrow, broken, and rocky bed in a succession of falls and cascades of great picturesque beauty. With much toil and difficulty we picked our way over a wide "talus" of huge, broken granite blocks and bowlders, along the foot of a vast mountain of solid granite on the south side of the river, until near the end of the defile, then crossed the stream, and soon after encountered a still larger branch coming from the north, direct from Takhoma, the product, doubtless, of the glaciers on the southern and southwestern sides. Fording this branch just above its confluence with the other, we followed the general course of the river, now unmistakably the Nisqually, for about four miles; then, leaving it, we struck off nearly south through the forest for three miles, and emerged upon the Bear Prairie. The distance was about thir-

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teen miles from where we left Van Trump, and we were only some six hours in traveling it, while it took seventeen hours of terribly severe work to make the mountain-route under Sluiskin's guidance.

Without his help on the shorter route, too, it would have taken me more than twice the time it did. For the manner in which, after entering the defile of the Nisqually, Sluiskin again took the lead and proceeded in a direct and unhesitating course, securing every advantage of the ground, availing himself of the wide, rocky bars along the river, crossing and recrossing the milky flood which rushed along with terrific swiftness and fury, and occasionally forcing his way through the thick timber and underbrush in order to cut off wide bends of the river, and at length leaving it and striking boldly through the forest to Bear Prairie, proved him familiar with every foot of the country. His objections to the route evidently arose from the jealousy so common with his people of further exploration of the country by the whites. As long as they keep within the limits already known and explored, they are faithful and indefatigable guides, but they invariably interpose every obstacle their ingenuity can suggest to deter the adventurous mountaineer from exposing the few last hidden recesses that remain unexplored.

Mr. Coleman was found safe in camp, and seemed too glad to see us to think of reproaching us for our summary abandonment. He said that in attempting to follow us he climbed up so precipitous a place that, encumbered with his heavy pack, he could neither advance nor recede. He was compelled, therefore, to throw off the pack, which rolled to the very bottom of the mountain, and being thus delivered of his necessary outfit, he was forced to return to camp. He had been unable to find his pack, but having come across some cricketer's spikes among his remaining effects, he was resolved to continue his trip to, and make the ascent of, Rainier by himself; he had just completed his

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preparations, and especially had deposited on top of the lofty mountain which overlooked the prairie two caches, or stores, of provisions.

At daylight next morning, Sluiskin, with his little boy riding one of his own ponies, himself riding our little calico-colored pack-horse, now well rested and saucy, started back for Van Trump, with directions to meet us at the trail on the Nisqually. A heavy, drizzling rain set in soon afterwards; Mr. Coleman, who had gone early to bring in the contents of his mountain-top caches, returned about noon with a very small bundle, and, packing our traps upon Sluiskin's other pony, we moved over to the rendezvous, pitched Coleman's large gum-sheet as a partial shelter, made a rousing fire, and tried to be comfortable. Late in the afternoon the pony set up a violent neighing, and in a few minutes Van Trump, and Sluiskin with his little boy behind him, rode up, drenched to the skin. By following the bed of the river, frequently crossing and recrossing, the Indian had managed to ride to the very foot of the Nisqually defile, when, leaving the horses in this boy's care, he hastened to Van Trump and carefully led and assisted him down. Despite the pain of his severe hurts, the latter was much amused at Sluiskin's account of our trip, and of finding Mr. Coleman safe in camp making tea, and for long after would repeat as an excellent joke Sluiskin's remark on passing the point where he had attempted to mislead me, "Skookum tenas man hiyu goddam."

We sent the horses back by the Indian to Bear Prairie for grass, there being no indications of the rain ceasing. The storm indeed lasted three days, during which we remained sheltered beneath the gum-sheet as far as possible, and endeavored to counteract the rain by heaping up our fire in front. About eight o'clock on the second morning, Sluiskin reported himself with our horse, which he returned, he said, because he was about to return to his lodge on the Cowlitz, being des-

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titute of shelter and food for his family on Bear Prairie. He vigorously replenished the fire, declined breakfast, jeered Coleman for turning back, although probably the latter did not comprehend his broken lingo, and departed.

Sluiskin was an original and striking character. Leading a solitary life of hardships amidst these wilds, yet of unusual native intelligence, he had contrived, during rare visits to the settlements, to acquire the Chinook jargon, besides a considerable stock of English words, while his fund of general information was really wonderful. He was possessed of a shrewd, sarcastic wit, and, making no pretense to the traditional gravity of his race, did not scruple to use it freely. Yet beneath this he cherished a high sense of pride and personal independence. Although of the blood of the numerous and powerful Yakimas, who occupied the country just east of the Cascades, he disdained to render allegiance to them or any tribe, and undoubtedly regarded the superintendent of Indian affairs, or even the great father at Washington himself, with equally contemptuous indifference.

As the last rays of the sun, one warm, drowsy summer afternoon, were falling aslant the shady streets of Olympia, Mr. Longmire's well-worn family carry-all, drawn by two fat, grass-fed horses, came rattling down the main street at a most unusual pace for them; two bright flags attached to Alpine staffs, one projecting from each door, fluttered gayly overhead, while the occupants of the carriage looked eagerly forth to catch the first glimpse of welcoming friends. We returned after our tramp of two hundred and forty miles with visages tanned and sun-scorched, and with forms as lean and gaunt as greyhounds, and were received and lionized to the full, like veterans returning from an arduous and glorious campaign. For days afterward, in walking along the smooth and level pavements, we felt a strong impulse to step high, as though still striding over the

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innumerable fallen logs and boughs of the forest, and for weeks our appetites were a source of astonishment to our friends and somewhat mortifying to ourselves. More than two months had elapsed before Mr. Van Trump fully recovered from his hurts. We published at the time short newspaper accounts of the ascent, and, although an occasional old Puget Sounder will still growl, "They say they went on top of Mount Rainier, but I'd like to see them prove it," we were justly regarded as the first, and as I believe the only ones up to the present time, who have ever achieved the summit of Takhoma.

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VII. INDIAN WARNING AGAINST DEMONS

By SLUISKIN, INDIAN GUIDE

The beautiful Sluiskin Falls, at the head of Paradise Valley, have been admired by countless visitors to the Mount Rainier National Park. The name was bestowed upon them by Stevens and Van Trump after their return from what the Indian guide believed was sure death. Before they had left him at the camp near the falls and started to climb over the snow and ice, he delivered an eloquent plea in the Chinook jargon accompanied by natural but effective gestures.

The speech was remembered and repeated by the white men when they returned among their friends. One of those who committed it to memory was former Congressman M. C. George of Oregon. He furnished a copy. General Stevens in 1915 revised it, but added: "My Chinook I have somewhat lost, so the rendering is probably not so correct as it might be."

However, the Indian speech and the translation by General Stevens will likely be cherished as here reproduced.

Kloshe nanich, mesika kloshe tilikum. Nika tikigh wawa kopa mesika.

Mesika tikegh klatawa saghalie Takhoma, hyiu pelton. Halo tilikum mamook okoke pe mitlite. Hyas tyee mitlite kopa saghalie illahee kopa hyiu piah. Wake tikigh tilikum chako kopa yahka illahee.

Ahnkuttie nika papa yahka papa, hyas skookum tyee kopa konaway Yakima tilikum, klatawa wake siah yahka la tet. Alta nanich piah chuck pe keekwulee tyee chako mimoluse yahka pe hyak klatawa keekwulee saghalie illahee, pe hyiu kloshe tumtum. Yahka wake mamook alta, halo ikt siwash mamook klatawa.

Kloshe mesika klatawa, kloshe mamook. Hyiu snow, kloshe klatawa snow illahee, ahnkuttie nika mimoluse Takhoma mowich kloshe ooakut. Alta

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mesika nanich klatawa hyiu stone, wake kloshe klatawa pe mesika teahwit tseepie alta mesika klatawa keekwulee pe mimoluse, keekwulee pe mimoluse. Mesika klatawa hyas mesachie snow pe keekwulee hyas mesachie illahee yahka Takhoma mowich halo klatawa. Mesika klatawa hyas saghalie illahee hyiu stone chako, hyiu stone chako, pe mesika mimoluse pe kokshut mesika.

Spose mesika klatawa kopa okoke saghalie illahee alta mesika hyiu skookum pe cole wind alta yahka mahsh mesika kopa keekwulee illahee pe mimoluse mesika. Spose mesika mitlite mesachie iktas hyas keekwulee tyee mitlite Takhoma mesika mimoluse pe mesika mahsh okoke piah chuck.

Wake mesika klatawa!

Mesika mamook nika tumtum kwass, spose mesika klatawa Takhoma saghalie. Mesika mimoluse mesika spose klatawa Takhoma. Mesika mimoluse pe mesika tilikum sollecks kopa nika.

Wake klatawa!

Wake klatawa!

Spose mesika klatawa, nika mitlite mokst sun pe alta nika klatawa kopa Olympia pe wawa kopa mesika tilikum alta mesika mimoluse siah saghalie Takhoma. Mesika potlatch pehpah kopa nika mamook kumtuks mesika mimoluse wake nika mesachie.

Kopet wawa nika.

Translation by General Stevens

Listen to me, my good friends. I must talk to you.

Your plan to climb Takhoma is all foolishness. No one can do it and live. A mighty chief dwells upon the summit in a lake of fire. He brooks no intruders.

Many years ago my grandfather, the greatest and bravest chief of all the Yakima, climbed nearly to the summit. There he caught sight of the fiery lake and the infernal demon coming to destroy him, and he

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fled down the mountain, glad to escape with his life. Where he failed, no other Indian ever dared make the attempt.

At first the way is easy, the task seems light. The broad snowfields, over which I have often hunted the mountain goat, offer an inviting path. But above them you will have to climb over steep rocks overhanging deep gorges where a misstep would hurl you far down — down to certain death. You must creep over steep snow banks and cross deep crevasses where a mountain goat could hardly keep his footing. You must climb along steep cliffs where rocks are continually falling to crush you, or knock you off into the bottomless depths.

And if you should escape these perils and reach the great snowy dome, then a bitterly cold and furious tempest will sweep you off into space like a withered leaf. But if by some miracle you should survive all these perils the mighty demon of Takhoma will surely kill you and throw you into the fiery lake.

Don't you go!

You make my heart sick when you talk of climbing Takhoma. You will perish if you try to climb Takhoma. You will perish and your people will blame me.

Don't go!

Don't go!

If you will go, I will wait here two days, and then go to Olympia and tell your people that you perished on Takhoma. Give me a paper to them to let them know that I am not to blame for your death.

My talk is ended.

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SAMUEL FRANKLIN EMMONS.

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VIII. SECOND SUCCESSFUL ASCENT, 1870

By S. F. EMMONS

Later in the same year, 1870, when Stevens and Van Trump made their first successful ascent, the achievement was also accomplished by S. F. Emmons and A. D. Wilson of the Geological Exploration of the Fortieth Parallel. Samuel Franklin Emmons was born at Boston on March 29, 1841. He died painlessly and unexpectedly on the eve of his seventieth birthday, March 28, 1911.

George F. Becker gave him a fervent eulogy which appeared in the Transactions of the American Institute of Mining Engineers for 1911. He says: "There is not a geological society or even a mining camp from Arctic Finland to the Transvaal, or from Alaska to Australia, where Emmons's name is not honored and his authority recognized." With all his fame and ability, the biographer declares, he was modest to diffidence.

His account of the ascent is in the form of a letter to his chief, Clarence King, who published it in the American Journal of Science for March, 1871. It is here reproduced from that source. The photograph of Mr. Emmons was obtained from the United States Geological Survey. It will be noticed that Mr. Emmons calls the mountain Tachoma.

The Mountain's largest glacier, to which he refers with enthusiasm, was for a long time known by the name of White River which it feeds. It is peculiarly appropriate that that glacier should bear the name given it on the official map of the United States Geological Survey — Emmons Glacier.

The glaciers of Mt. Tachoma, or Rainier as it is more commonly called, form the principal sources of four important rivers of Washington Territory, viz: the Cowlitz, which flows into the Columbia, and the Nisqually, Puyallup and White rivers which empty into Puget Sound. In accordance with your instructions, Mr. A. D. Wilson and I visited this mountain in the early part of October, 1870, and carried the work

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of making its complete survey, both geological and topographical, as far as the lateness of the season and the means at our disposal would permit. As the topographical work has not yet been plotted, the figures given in my notes are merely estimates, and liable to subsequent correction. I herewith transmit an abstract from my notes upon the glaciers, embracing those of rather more than half the slopes of the mountain, those on the eastern side, from the extreme southern to the extreme northern point.

The summit of Tachoma is formed by three peaks, a southern, an eastern, and a northwestern: of these the eastern is the highest; those on the south and northwest, being apparently a few hundred feet lower, are distant about a mile and a half to two miles from this, and separated by deep valleys. The eastern peak, which would seem to have formed originally the middle of the mountain mass, is a crater about a quarter of a mile in diameter of very perfect circular form. Its sides are bare for about 60 feet from the rim, below which they are covered by a *névé* having a slope of from 28° to 31°. This *névé* extending from the shoulders of the southwestern peak to those of the northern, a width of several miles, descends to a vertical distance of about 2000 feet below the crater rim, an immense sheet of white granular ice, having the general form of the mountain surface, and broken only by long transverse crevasses, one of those observed being from one to two miles in length: it is then divided up by the several jutting rock-masses or shoulder of the mountain into the Nisqually, Cowlitz and White River glaciers, falling in distinct ice cascades for about 3000 feet at very steep angles, which sometimes approach the perpendicular. From the foot of these cascades flow the glaciers proper, at a more gentle angle, growing narrower and sinking deeper into the mountain as they descend. From the intervening spurs, which slope even more gradually, they receive many tributary

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glaciers, while some of these secondary glaciers form independent streams, which only join the main river many miles below the end of the glaciers.

The Nisqually, the narrowest of the three main glaciers above mentioned, has the most sinuous course, varying in direction from southwest to south, while its lower extremity is somewhat west of south of the main peak: it receives most of its tributaries from the spur to the east, and has a comparatively regular slope in its whole length below the cascades. There are some indications of dirt-bands on its surface, when seen from a considerable elevation. Toward its lower end it is very much broken up by transverse and longitudinal crevasses: this is due to the fact, that it has here cut through the more yielding strata of volcanic rock, and come upon an underlying and unconformable mass of syenite. The ice front at its base is about 500 feet in height, and the walls of lava which bound its sides rise from 1000 to 1500 feet above the surface of the ice, generally in sheer precipices.

The bed of the Cowlitz glacier is generally parallel to that of the Nisqually, though its curves are less marked: the ice cascades in which each originates, fall on either side of a black cliff of bedded lava and breccia scarcely a thousand feet in horizontal thickness, while the mouths of the glaciers, if I may be allowed the expression, are about three miles apart. From the jutting edge of this cliff hang enormous icicles from 75 to 100 feet in length. The slope of this glacier is less regular, being broken by subordinate ice cascades. Like the Nisqually its lower extremity stretches out as it were into the forest, the slopes on either side, where not too steep, being covered with the mountain fir (*Picea nobilis*) for several hundred feet above the level of the ice, while the *Pinus flexilis* grows at least 2000 feet higher than the mouth of the glacier.

The general course of this glacier is south, but at its extremity it bends to the eastward, apparently de-

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flected from its course by a cliff of older felsitic rock, more resisting than the lava. The consequence of this deflection is a predominance of longitudinal over transverse crevasses at this point, and an unusually large moraine at its western side, which rises several hundred feet above the surface of the glaciers, and partakes of the character of both lateral and terminal moraines: the main medial moraine of the glacier joins this near its lower end. This medial moraine proceeds from the cliff which bounds the ice cascade source of the glacier on the north, and brings down a dark porous lava which is only found high up on the mountain near the crater. The position of the medial moraine on the glacier would indicate that at least half its mass came from the spur on the east, which is probably the case.

This spur, comprehending the whole mass between the Cowlitz and White Rivers glaciers, has the shape of a triangle whose apex is formed by a huge pinnacle of rock, which, as its bedding indicates, once formed part of the crust of the mountain, but now stands isolated, a jagged peak rising about 3000 feet above the glaciers at its foot, so steep that neither ice nor snow rest upon it. One of the tributaries to the Cowlitz glacier from this spur brings down with it a second medial moraine, which is traceable to the mouth of the glacier, though in general these tributary glaciers bring no medial moraines.

On the eastern slopes of this spur between the two above named glaciers, spread secondary glaciers, frequently of great width, but owing to the limited height of their initial points, of inconsiderable length. These end generally in perpendicular cliffs overhanging the rocky amphitheaters at the heads of the smaller streams which flow eastward into the Cowlitz. Looking up from the bottom of one of these amphitheaters one sees a semi-circular wall of nearly 2000 feet of sheer rock, surmounted by about 500 feet of ice, from

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under which small streams of water issue, falling in silvery cascades on to the green bottom below.

A ridge of high jagged peaks connects this spur with the main range of the Cascade Mts. in the east, and forms the water-shed between the White and Cowlitz rivers. From the connecting saddle one can look northward across the brink of six glaciers, which all contribute to the White River; of these the first four come from the triangular spur already mentioned and are of comparatively little extent. The first two are, however, interesting from the vein structure which they exhibit; they both originate in an irregularly oblong basin, having the shape somewhat of an inclined ellipse, turning on its longer diameter, the outlets of the glacier being opposite the foci. Seen from a high point the veins form concentric lines generally parallel to the sides of the basin; the ends of those towards the center gradually bend round, until they join together in the form of a figure 8, and finally just above the outlets form two small ellipses. They thus constantly preserve a direction at right angles to that of the pressure exerted, downward by the movement of the ice mass, and upward by the resistance to this movement of the rock mass between the two outlets.

The main White River glacier, the grandest of the whole,[1] pours straight down from the rim of the crater in a northeasterly direction, and pushes its extremity farther out into the valley than any of the others. Its greatest width on the steep slope of the mountain must be four or five miles, narrowing towards its extremity to about a mile and a half; its length can be scarcely less than ten miles. The great eroding power of glacial ice is strikingly illustrated in this glacier, which seems to have cut down and carried away on the northeastern side of the mountain, fully a third of its mass. The thickness of rock cut away as shown by the walls on either side, and the isolated peak at the head of the

[1] It is a pleasure to note that this fine glacier now bears the name of Emmons.

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IX. EXPLORATIONS ON THE NORTHERN SLOPES, 1881–1883

By BAILEY WILLIS

The Northwest for April, 1883, which was Number 2 of Volume I of that magazine, contained an article by Bailey Willis, Assistant Geologist of the Northern Transcontinental Survey. The article is entitled "Canyons and Glaciers. A Journey to the Ice Fields of Mount Tacoma." Mr. Willis was born at Idlewild-on-Hudson, New York, on May 31, 1857. It speaks well for his skill and training that he should have attained to such a position at twenty-four years of age.

Since then he has worked out a great career in the United States Geological Survey, in China and in other parts of the world. He is now Professor of Geology at Stanford University. He has kindly revised for this publication the product of his younger years. And there has also been found a photograph of the geologist as he appeared when the surveys were made.

To this day, people who visit the northern slopes and parks of the mountain become familiar with the Bailey Willis trail and from Moraine Park they get a view of the wonderful Willis Wall named in his honor.

The Puyallup River, which empties into Puget Sound near New Tacoma, heads in three glaciers on Mount Tacoma. During the summer months, when the ice and snow on the mountains are thawing, the water is discolored with mud from the glaciers and carries a large amount of sediment out to Commencement Bay. If the Coast Survey charts are correct, soundings near the centre of the bay have changed from one hundred fathoms and "no bottom" in 1867, to eighty fathoms and "gray mud" in 1877. But when the nights in the hills begin to be frosty, the stream becomes clearer, and in winter the greater volume of spring water gives it a deep green tint.

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BAILEY WILLIS.
From a photograph taken in 1883.

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For twenty miles from the Sound the valley is nearly level. The bluffs along the river are of coarse gravel, the soil is alluvium, and a well sunk a hundred feet at the little town of Puyallup passed through gravel and sand to tide mud and brackish water. From the foot-hills to its mouth the river meanders over an old valley of unknown depth, now filled with material brought down by its several branches. About eighteen miles above its mouth the river forks, and the northern portion takes the name of Carbon River; the southern was formerly called the South Fork, but it should retain the name of Puyallup to its next division far up in the mountains. A short distance above their junction both Carbon River and the Puyallup escape from narrow, crooked cañons, whose vertical sides, one hundred to three hundred feet high, are often but fifty feet apart. From these walls steep, heavily timbered slopes rise two hundred to eight hundred feet to the summits of the foot-hills. These cañons link the buried river basin of the lower stream with the upper river valleys. The latter extend from the heads of the cañons to the glaciers. They are apparently the deserted beds of mightier ice rivers, now shrunk to the very foot of Mount Tacoma.

From New Tacoma the entire course of the Puyallup and part of Carbon River are in view. Across Commencement Bay are the tide marshes of the delta; back from these salt meadows the light green of the cottonwoods, alder and vine-maple mark the river's course, till it is lost in the dark monotone of the fir forest. No break in the evergreen surface indicates the place of the river cañons; but far out among the foot-hills a line of mist hangs over the upper valley of Carbon River, which winds away eastward, behind the rising ground, to the northern side of Mount Tacoma. Milk Creek, one of its branches, drains the northwest spur, and on the western slope the snows accumulate in two glaciers, from which flow the North

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and South Forks of the Puyallup. These streams meet in a level valley at the base of three singular peaks, and plunge united into the dark gateway of the cañon.

A trip to the grand snow peak from which these rivers spring was within a year a very difficult undertaking. There was no trail through the dense forest, no supply depot on the route. No horse nor donkey could accompany the explorer, who took his blankets and provisions on his back, and worked his way slowly among the towering tree trunks, through underbrush luxuriant as a tropic jungle. But last summer a good horse trail was built from Wilkeson to Carbon River, crossing it above the cañon, sixteen miles below the glacier, and during the autumn it was extended to the head of the Puyallup. Wilkeson is reached by a branch railroad from New Tacoma. It is on a small tributary of Carbon River, called Fletts Creek, at a point where the brook runs from a narrow gorge into a valley about a quarter of a mile wide. Coal mines are opened at this point. The horse trail climbs at once from Wilkeson to the first terrace, four hundred feet above the valley; then winds a quarter of a mile back through the forest to the second ascent of a hundred feet, and then a mile over the level to the third. Hidden here beneath the thick covering of moss and undergrowth of the primeval forest, fourteen hundred feet above the present ocean level, are ancient shore lines of the sea, which has left its trace in similar terraces in all the valleys about the Sound.[1] Thence the trail extends southward over a level plateau. Carbon River Cañon is but half a mile away on the west, and five miles from Wilkeson the valley above the cañon is reached. The descent to the river is over three miles along the hillside eastward.

[1] The terraces to which reference is here made are not the work of the sea, but of lakes whose waters gathered between the mountain slopes and retreating glaciers of the ice period. See the article by H. I. Bretz. Geol. Survey of Wash., Bull. 8, 1912.

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From Wilkeson to the river the way is all through a belt of forest, where the conditions of growth are very favorable. The fir trees are massive, straight and free from limbs to a great height. The larger ones, eight to twelve feet in diameter on a level with a man's head, carry their size upward, tapering very gradually, till near the top they shoot out a thick mat of foliage and the trunk in a few feet diminishes to a point. One such was measured; it stands like a huge obelisk 180 feet, without a limb, supporting a crown of but forty feet more. The more slender trees are, curiously enough, the taller; straight, clear shafts rise 100 to 150 feet, topped with foliage whose highest needles would look down on Trinity spire. Cedars, hemlocks, spruce and white fir mingle with these giants, but they do not compete with them in height; they fill in the spaces in the vast colonnades. Below is the carpet of deep golden green moss and glossy ferns, and the tangle of vines and bushes that cover the fallen trunks of the fathers of the forest.

The silence of these mountains is awesome, the solitude oppressive. The deer, the bear, the panther are seldom met; they see and hear first and silently slip away, leaving only their tracks to prove their numbers. There are very few birds. Blue jays, and their less showy gray, but equally impudent, cousins, the "whiskey jacks," assemble about a camp; but in passing through the forest one may wander a whole day and see no living thing save a squirrel, whose shrill chatter is startling amid the silence. The wind plays in the tree tops far overhead, but seldom stirs the branches of the smaller growth. The great tree trunks stand immovable. The more awful is it when a gale roars through the timber; when the huge columns sway in unison and groan with voices strangely human. It is fearful to lie in the utter darkness of a stormy night, listening to the pulsating rush of the wind, the moan of the forest and the crash of uprooted giants upon

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the ground — listening with bated breath for the report which may foretell the fall of yonder tall decaying shaft, whose thick, deep cleft bark blazed so brightly on the now dying camp fire. The effect of one such storm is seen in Carbon River Valley, above and below where the trail crosses. The blast followed the stream and the mountain slope on the south side; over an area eight miles long and a half a mile to a mile wide the forest is prostrate. Single trees stand gaunt and charred by a recent fire, but their comrades are piled like jackstraws, the toys of the tornado. Over and under each other they lie, bent and interlaced, twenty, thirty feet deep. Pigmy man strained his eyes to see their tops, when they stood erect; now he vainly stands on tiptoe to look over them in their fallen majesty.

To the head of Carbon River from the bridge, on which the trail crosses it, is about sixteen miles. The rocky bed of the river is 100 to 200 yards wide, a gray strip of polished boulders between sombre mountain slopes, that rise sharply from it. The stream winds in ever-shifting channels among the stones. About six miles above the bridge Milk Creek dashes down from its narrow gorge into the river. The high pinnacles of the spur from which it springs are hidden by the nearer fir-clad ridges. Between their outlines shines the northern peak of Mount Tacoma, framed in dark evergreen spires. Its snow fields are only three miles distant, but Carbon River has come a long way round. For six miles eastward the undulating lines of the mountains converge, then those on the north suddenly cross the view, where the river cañon turns sharply southward.

Three miles from this turn is Crescent Mountain, its summit a semi-circular gray wall a thousand feet high.[1] At sunset the light from the west streams across the

[1] The amphitheaters which the young geologist mistook for craters are now known to be glacier basins eroded by ice.

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head of Milk Creek and Carbon River, illuminating these cliffs as with the glow of volcanic fires, while twilight deepens in the valley. The next turn of the river brings Mount Tacoma again in view. Close on the right a huge buttress towers up, cliff upon cliff, 2,500 feet, a single one of the many imposing rock masses that form the Ragged Spur between Carbon River and Milk Creek. The more rapid fall of the river, the increasing size of the boulders, show the nearness of the glacier. Turning eastward to the south of Crescent Mountain, you pass the group of trees that hide it.

This first sight is a disappointment. The glacier is a very dirty one. The face is about 300 feet long and thirty to forty feet high. It entirely fills the space between two low cliffs of polished gray rock. Throughout the mass the snows of successive winters are interstratified with the summers' accumulations of earth and rock. From a dark cavern, whose depths have none of the intense blue color so beautiful in crevasses in clear ice, Carbon River pours out, a muddy torrent. The top of the glacier is covered with earth about six inches deep, contributed to its mass by the cliffs on either side and by an island of rock, where a few pines grow, entirely surrounded by the ice river. The eye willingly passes over this dirty mass to the gleaming northeast spur of the mountain, where the sunlight lingers after the chill night wind has begun to blow from the ice fields.

The disappointment of this view of the glacier leaves one unprepared for the beauty of that from Crescent Mountain. The ascent from a point a short distance down the river is steep, but not dangerous. The lower slopes are heavily timbered, but at an elevation of 4,000 feet juniper and dwarf pine are dotted over the grassy hillside. Elk, deer and white mountain goats find here a pleasant pasture; their trails look like well trodden sheep paths on a New England hill. A curious badger-like animal, sitting erect on his hind legs, greets one

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with a long shrill whistle that would make a schoolboy envious, but trots quickly away on nearer approach. The crest of the southwest rim of the amphitheater is easily gained, and the grandeur of the view bursts upon you suddenly. Eastward are the cliffs and cañons of the Cascade Range. Northward forest-covered hill and valley reach to Mount Baker and the snow peaks that break the horizon line. Westward are the blue waters of the Sound, the snow-clad Olympics and a faint soft line beyond; it may be the ocean or a fog bank above it. Southward, 9,000 feet above you, so near you must throw your head back to see its summit, is grand Mount Tacoma; its graceful northern peak piercing the sky, it soars single and alone. Whether touched by the glow of early morning or gleaming in bright noonday, whether rosy with sunset light or glimmering ghost-like, in the full moon, whether standing out clear and cloudless or veiled among the mists it weaves from the warm south winds, it is always majestic and inspiring, always attractive and lovely. It is the symbol of an awful power clad in beauty.

This northern slope of the mountain is very steep, and the consolidated snow begins its downward movement from near the top. Little pinnacles of rock project through the mass and form eddies in the current. A jagged ridge divides it, and part descends into the deep unexplored cañon of White River, probably the deepest chasm in the flanks of Mount Tacoma. The other part comes straight on toward the southern side of Crescent Mountain, a precipice 2,000 feet high; diverted, it turns in graceful flowing curves, breaks into a thousand ice pyramids and descends into the narrow pass, where its beauty is hidden under the ever-falling showers of rock.

This rim you stand upon is very narrow; a hundred feet wide, sometimes less, between the cliff that rises 2,000 feet above the glacier and the descent of a thou-

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sand feet on the other side. Snow lies upon part of this slope; stones, started from the edge, leap in lengthening bounds over its firm surface and plunge with a splash into the throat of the lakelet that lies in the amphitheater. The ice slope, dipping into the clear water, passes from purest white to deepest blue as it passes out of sight in the depths of the basin.

A two days' visit to this trackless region sufficed only to see a small part of the magnificent scenery. White River Cañon, the cliffs of Ragged Spur, the northern slope of Mount Tacoma, where the climber is always tempted upward, might occupy him for weeks. Across the snow fields, where Milk Creek rises, is the glacier of the North Fork of the Puyallup, and the end of the horse trail we left at Carbon River is within six miles of its base. When a trail is built up Carbon River, the way across this divide will be found, and, with comfortable stopping places on the two rivers, the tourist can pass a delightful week amid scenery we now cross the ocean to Switzerland to see.

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X. DISCOVERY OF CAMP MUIR, 1888

By MAJOR E. S. INGRAHAM

MAJOR EDWARD STURGIS INGRAHAM has visited the mountain annually since 1888. He has ascended to the summit seven times and has spent as many nights in the crater. It was he who gave to a number of the prominent features of the Park their beautiful and enduring names.

On his first ascent in 1888 the party included John Muir, most famous naturalist of the Pacific Slope. Since he found a sheltered pumice patch and suggested camping there for the night, Major Ingraham called it Camp Muir, now well known to all climbers.

Major Ingraham prepared an account of the ascent which was published in The Puget Sound Magazine for October, 1888. That magazine has long since ceased to be issued. It was edited by the editor of this present work, who has rescued the article from the rare and almost forgotten files.

After an extensive career as superintendent of schools, printer, militia officer and miner, Major Ingraham has been devoting his later years to the boy scout work, in which his love for the mountains plays an important part.

A glacier on the mountain bears the name of Ingraham. How that came to be, is related by him as follows: "One time when I was on the mountain encamped at the Camp of the Clouds, Professor I. C. Russell and another man, both in their shirt sleeves, came tottering into my camp at early morning. They had been caught upon the summit and had spent a shivering night in the crater. I treated them the best I knew how and they departed. When their maps came out I found that a beautiful glacier had been named for me — Ingraham Glacier."

Mount Rainier, one of Nature's masterpieces, is the most striking object of grandeur and beauty amidst the unsurpassed scenery of Washington Territory. Occupying nearly a central position geographically in the Territory, it is alike an object of pride to the inhabitants of the Great Plain of the Columbia and

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MAJOR EDWARD STURGIS INGRAHAM.

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to the dwellers on Puget Sound. There are other peaks that command our attention, but it is to the old monarch that we turn with unfeigned pride and exclaim, "Behold a masterpiece!"

The height of Mount Rainier, as estimated by triangulation, is 14,444 feet. This height was verified by barometer in the hands of one party that reached the summit in the month of August of the present year. From many points of view it appears a single peak; but in reality it is composed of three peaks of nearly the same height. These peaks may be designated as northern, crater and southern. They are not in direct line, but occupy apexes of an obtuse-angled triangle. The northern peak is a cone, with its apex about two miles from the summit of crater peak; the southern peak is somewhat flattened on top, and is about one and one-half miles from crater peak. Crater peak, as the name suggests, has two large craters, with well-defined rims — one sloping slightly towards the northeast, and the other towards the southwest. The culminating point of this peak is a sugarloaf-shape mass of pure snow, about one hundred feet above all adjacent points. The northern and southern peaks are inaccessible, except from crater peak, owing to the precipitous condition of their sides, which are so steep that snow will not cling to them except in small patches. Down these sides, during some seasons of the year, avalanches go thundering almost hourly with a roar that makes the tourist shudder with fear.

The volcanic condition of Mount Rainier is everywhere apparent. For miles before the base is reached vast quantities of ashes, forming the greater part of the soil of that region, plainly tell of extensive eruptions; the immediate foothills are covered with masses of red and black lava; while pumice is found in great abundance upon some of the ridges. All these evidences suggest that, long ages ago, Rainier was the scene of volcanic activity of immense magnitude.

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Ascend to the top, behold the two well-defined craters, with their rims perfect; descend those walls, and try to count the many jets of steam constantly puffing forth their sulphurous odors, and one is led to believe that Rainier has been active at a comparatively recent period.

Mount Rainier, with its many glaciers, is the source of the principal rivers of Western Washington. From the summit of the three peaks the snow forges its way downward until it is compressed into ice; the ice in turn is compressed until it assumes that peculiar blue tint that characterizes ice under great pressure. These ice streams move slowly down the valleys, about one foot in twenty-four hours, conforming to their beds. Where the bed is inclined, the glacier breaks into innumerable masses, somewhat regular, with great yawning crevasses between. While crossing one of the White River glaciers below an ice-fall I had to stand clear of a dozen bowlders that came rolling down from the brink, telling very forcibly that the glacier was moving. These glaciers plow their way down the valleys to an elevation of between 3000 and 4000 feet, and there dissolve into water. Some of them terminate in a gentle incline; others present a high wall of clear ice, with the river issuing from an immense cave; still others deposit vast quantities of stones and earth, forming what is called the "terminal moraine." The glaciers of the northern peak, five in number, form the Puyallup and its principal tributary, the Carbon; the twelve glaciers of the eastern slope of crater peak yield the icy waters of the White and Cowlitz; the glaciers of the southern peak form the several sources of the Nisqually. The glaciers are from one to two miles in width, and from six to twelve miles in length. Like the rivers which they form, they themselves have tributaries. When two glaciers unite, their inside lateral moraines join and form a medial moraine.

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The ascent of Mount Rainier is difficult and dangerous. Three different parties have reached the summit from the south side—namely, Hazard Stevens and P. B. Van Trump in 1870; P. B. Van Trump, James Longmire and Mr. Bailey, in 1883; and a party of seven, of which the writer was the projector, in August of the present year. A party of three from Snohomish claim to have reached the summit by the northeast side in the summer of 1884. Several others and myself have made two attempts to reach the summit from that side, but came to an impassable crevasse at an elevation of about 14,000 feet on both occasions.

On the morning of the 10th of last August a party of eight gentlemen left Seattle for Yelm with the necessary equipments and provisions for a two weeks' sojourn among the eternal hills. At Yelm we secured the necessary horses to convey our outfit to the snow line on the south side. The day at Yelm was clear and beautiful — Mount Rainier never looked so grand before. Its three peaks stood out in bold relief against the sky, while its walls of ice sparkled with resplendent beauty. During the morning and evening the play of colors around its base, extending in graduated bands far towards the zenith, made our artist groan aloud because of his inability to transfer them to canvas. It took us three days from the time we left Yelm to reach the Longmire Mineral Springs. These springs were discovered by Mr. James Longmire in 1883. They number twenty-five or more, and are heavily charged with carbon dioxide and other gases that combine to make the water a very pleasant drink as well as a health-giving beverage. Around each spring is an incrustation of soda compounds deposited by the water. One spring, over which a rude bath-house has been constructed, pours forth a large quantity of water at a temperature of 85° Fahr. A bath in this water is pleasant and invigorating. The view from the springs is very beautiful. On the right is the swift flowing

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Nisqually; on the left, a solid white wall of basaltic rock rises to a height of nearly one thousand feet; while in front, seeming only a mile away, Mount Rainier stands in silent majesty. There were several visitors at the springs. In the near future these springs will be sought by hundreds of invalids. We would gladly have remained at the springs for several days, but, with the old monarch so near, we could not delay. The next day found all of the party but two on the tramp. That day's work was to ascend to Camp of the Clouds, distant about five miles from the springs. It was no small task. The trail is steep and rugged, and has been traveled but little. About three miles from the springs it crosses the Nisqually. From that point for a mile it is one of the steepest trails I have ever traveled. When the top was reached we were regaled by the sight and odor of flowers that surpassed description in odor and variety. From this point to Camp of the Clouds, two miles further on, our path was literally strewed with beautiful flowers. This entire region is a paradise for the botanist, and the flowers deserve a much fuller description.

At last, after four days of hard tramping, we have reached permanent camp at an elevation of about 6,000 feet. Here we unpack, pitch our tent and turn our jaded horses loose. Here we wish all our friends with us, and here we would gladly remain a month in deep enjoyment of the grandeur and beauty around us, but our time is limited and our friends far away.

Monday noon, August 14th, we carefully prepare for the ascent. It is light artillery now — a pair of blankets, a small supply of provisions, principally chocolate, and our Alpine staves complete the outfit. With cheerful hearts and steady nerves we begin the climb. It is our purpose to ascend to a height of about 10,000 feet and there make camp for the night. Soon we pass the timber line. Our pathway now lies over the eternal snow, broken only by a projecting spur of

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the mountain. After five hours of hard climbing, we come to a ridge covered with sand and pumice. From the presence of the latter we know it to be a spot comparatively free from wind, for, on account of the lightness of the pumice, it is easily blown away. Here we decide to camp. Two by two we go to work preparing our beds. This we do by clearing away the loose stones from a space about three by six feet, stirring the sand up with our pikes and making a wall of rocks around the cleared place. After a half hour's toil we declare our beds prepared. Hastily partaking of a little chocolate and hardtack, we "turn in," although the hour is early; but the wind is rising and the sharp, stinging cold is upon us. After passing a miserable night, we break camp at 4:30 o'clock. Throwing aside our blankets and part of our provisions, we begin the final ascent. Our course takes us along the crest of a rocky ridge and beneath a perpendicular wall of basalt over a thousand feet in height. Here the courage of one of the party failed him, and he concluded to go no farther. The most dangerous part of the ascent is along the base of this cliff. The earth pitches at an angle of 35° from its base, and at three particular places this incline is not over six feet wide, ending in a perpendicular jump-off of fifteen hundred feet to the Nisqually glacier below. After a half hour's crouching and crawling we get past this dangerous part of our undertaking. We must now ascend almost perpendicularly one thousand feet to the top of this wall. Ordinarily steps have to be cut in the snow and ice, but on this occasion the snow lay in little drifts that served as steps. Up this ladder of snow and ice, prepared by the winds, we climb, pausing every few steps "to take breath." The top is reached at last. Upon consulting our barometer we find we are 12,000 feet above the sea level. A halt is ordered to put six steel brads in the sole of each boot, to prevent us from slipping on the ice and hard snow that we must now encounter.

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From the crest of this cliff the incline of the mountain to the summit is less than at any other point and consequently fewer crevasses, the terror of the mountaineer. Bracing ourselves for the final effort, we resumed the march. On account of the continuous ascent and the rarity of the atmosphere we have to rest every twenty or thirty steps. Still ascending, avoiding the crevasses by a zigzag path, we at last reach the last one, or what might more properly be called the first crevasse. This crevasse is formed by the first breaking off of the snow as it begins to slide down the mountain. The upper side is often a perpendicular wall of hard snow from ten to fifty feet high. This same crevasse, for it extends half way round the mountain, prevented our further progress on two previous occasions, when attempting to reach the summit from the northeast slope. Luckily on this occasion we found a bridge that afforded us a safe passage over. From this point we can see a clear path to the summit. Upward we climb to where the rim of the crater seems but a few hundred feet away. Look! there is a jet of steam right ahead; one grand effort and I sit upon the rim of the crater. I shout a word of triumph which sounds strangely shrill to my companions below, who, one by one, soon gain my exalted position. The feeling of triumph that filled the heart of each one as he gained that sublime height can be realized by no one who has not been in a similar position.

Space precludes an extensive description of the view from our elevated position; Washington, Oregon and the Sound and sea lay below us. A roll of clouds extending entirely around the horizon somewhat obstructed the prospect, yet added to the beauty of the scene. Mts. Baker, Adams, Hood, St. Helens, and Jefferson appeared above the clouds; the Cascade and Olympic ranges, Puget Sound and numerous river basins appeared below, while the smoke of distant

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cities completed the scene. Reluctantly turning from this grand panorama of nature, I gave my attention to an examination of the craters. There are two, elliptical in shape, and from one-half to three-fourths of a mile across. Their rims are bare outside, and in to an average depth of thirty feet from the crest. This is owing to the internal heat and escaping steam, which issues from a hundred jets within the circumference of the craters. The steam escapes in intermittent jets from little orifices about three-fourths of an inch in diameter. The walls of the crater in some places are quite warm, all of which plainly indicates that Mount Rainier is a volcano, not extinct but slumbering.

The amount of steam that escapes from the crater at any one time varies with the atmospheric pressure. In fact, Mount Rainier is a reliable barometer, foretelling a storm with certainty. Everyone who has noted the appearance of the mountain from time to time is familiar with the peculiar white cloud that is frequently seen suspended just above the summit, while no other clouds are in sight. This peculiar cloud, caused by the condensation of escaping steam, is called "Rainier's cap," and is the forerunner of a storm. There was considerable snow in the craters, but it had the appearance of having recently fallen. I believe, should it cease to snow for two or three months, the crater would become entirely bare inside; but this is not possible, for it snows on Mount Rainier even in midsummer.

Our party spent about two hours on the summit. We would gladly have tarried longer, but the clouds were gradually approaching from all points, and we did not care to take the chance of spending a night in the crater. Our descent in some places was even more dangerous than the ascent, owing to the falling rock. I recall with a shudder the successful dodging of a shower of bowlders on their way down from the top of a cliff two thousand feet above. They were singing as

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merrily as a cannon ball just shot from a thirty-pounder as they passed my head.

Our party left the summit about two o'clock, and some of us reached "Camp of the Clouds" by six o'clock, descending in four hours the same distance that we were twelve hours in covering on the upward climb. The names of the party making this very successful ascent are: John Muir, P. B. Van Trump, A. C. Warner, D. W. Bass, N. O. Booth, C. V. Piper and E. S. Ingraham.

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PROFESSOR ISRAEL COOK RUSSELL.

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XI. EXPLORING THE MOUNTAIN AND ITS GLACIERS, 1896

By PROFESSOR I. C. RUSSELL

The name of Professor Israel Cook Russell is permanently associated with Mount Rainier. He was one of America's noted geologists. He was born near Garrattsville, New York, on December 10, 1852. Graduating from the University of the City of New York in 1872, he at once began his career in science. In 1874, he was a member of the United States party at Queenstown, New Zealand, to observe the transit of Venus. From 1878 to 1892, he wrought valuable work in geology for the United States Geological Survey. This took him to Alaska and various other parts of the country. He succeeded Alexander Winchell as Professor of Geology in the University of Michigan in 1892 and continued to spend his summers in field work. One of his trips was to the West Indies during the eruption of Mount Pelee.

Most of his summer trips were devoted to the mountains and valleys of Oregon and Washington. It was during one of these trips, in the summer of 1896, that he made the explorations of Mount Rainier the extensive record of which, fully illustrated, appeared in the Eighteenth Annual Report of the United States Geological Survey for 1896–1897. The essential portions of that record are here reproduced by permission of Director George Otis Smith of the Survey, who also kindly furnished a portrait of his former colleague.

Professor Russell was honored with the Doctor of Laws degree by his alma mater and by the University of Wisconsin. He died suddenly at the zenith of his power in 1906, leaving a widow, Mrs. J. Augusta (Olmstead) Russell and three daughters. An earnest appreciation of his character and work by G. K. Gilbert was published in The Journal of Geology, Volume XIV, number 8, November–December, 1906. When The Mountaineers Club ascended the mountain in 1909 they named in his honor Russell Cliff, a majestic crest near the summit and overlooking the Winthrop and Emmons glaciers, and later a glacier on the northern slope, near Carbon Glacier, was named Russell Glacier.

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The reconnaissance during which the notes for this essay were obtained began [1896] at Carbonado, a small coal-mining town about 20 miles southeast of Tacoma, with which it is connected by a branch of the Union [Northern] Pacific Railroad. Carbonado is situated on the border of the unbroken forest. Eastward to beyond the crest of the Cascade Mountains is a primeval forest, the density and magnificence of which it is impossible adequately to describe to one who is not somewhat familiar with the Puget Sound region. From Carbonado a trail, cut through the forest under the direction of Willis in 1881, leads to Carbon River, a stream flowing from Mount Rainier, which it formerly crossed by a bridge that is now destroyed, and thence continues to the west of the mountain to Busywild. A branch of this trail leads eastward to the north side of the mountain, making accessible a beautiful region near the timber line, known as Spray Park.

Our party consisted of Bailey Willis, geologist in charge, George Otis Smith and myself, assistants, and F. H. Ainsworth, Fred Koch, William B. Williams, and Michael Autier, camp hands.

From Carbonado we proceeded with pack animals along the Willis trail, already mentioned, to the crossing of Carbon River. We then left the main trail and went up the right bank of the river by a trail recently cut as far as the mouth of Chenuis Creek. At that locality our party was divided; Willis and myself, taking blankets, rations, etc., and crossing the river, proceeded up its bowlder-strewn left bank to the foot of Carbon Glacier. The remainder of the party cut a trail along the right bank, and in the course of a few days succeeded in making a depot of supplies near where the river emerges from beneath the extremity of the glacier. The pack train was then taken back to near Carbonado for pasture.

The tramp from Carbonado to the foot of the Carbon

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Glacier was full of interest, as it revealed the characteristics of a great region, covered with a dense forest, which is a part of the deeply dissected Tertiary peneplain surrounding Mount Rainier. The rocks from Carbonado to Carbon River crossing are coal bearing. Extensive mines are worked at Carbonado, and test shafts have been opened at a few localities near the trail which we followed. At Carbonado the river flows through a steep-sided canyon about 300 feet deep. Near where the Willis trail crosses the stream the canyon broadens, is deeply filled with bowlders, and is bordered by forest-covered mountains fully 3,000 feet in elevation. On account of the dense forests, the scenery throughout the region traversed is wild and picturesque. At a few localities glimpses were obtained of the great snow-clad dome of Mount Rainier, rising far over the intervening tree-covered foothills.

The forests of the Puget Sound region are the most magnificent on the continent. The moist atmosphere and genial climate have led to a wonderfully luxuriant growth, especially of evergreens. Huge fir trees and cedars stand in close-set ranks and shoot upward straight and massive to heights which frequently exceed 250 feet, and sometimes are even in excess of 300 feet. The trees are frequently 10 to 12 feet or more in diameter at the height of one's head and rise in massive columns without a blemish to the first branches, which are in many instances 150 feet from the ground. The soil beneath the mighty trees is deeply covered with mosses of many harmonious tints, and decked with rank ferns, whose gracefully bending fronds attain a length of 6 to 8 feet. Lithe, slender maples, termed vine-maples from their habit of growth, are plentiful, especially along the small water courses. In many places the broad leaves of the devil's club (*Fatsia horrida*) give an almost tropical luxuriance to the shadowy realm beneath the lofty canopies formed by the firs and cedars.

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[A quotation from Bailey Willis is omitted, as the whole article is published in this work — Chapter IX.]

The mighty forest through which we traveled from Carbonado to the crossing of Carbon River extends over the country all about Mount Rainier and clothes the sides of the mountain to a height of about 6,000 feet. From distant points of view it appears as an unbroken emerald setting for the gleaming, jewel-like summit of the snow-covered peak.

In spite of the many attractions of the forest, it was with a sense of relief that we entered the canyon of Carbon River and had space to see about us. The river presents features of geographical interest, especially in the fact that it is filling in its valley. The load of stone contributed by the glaciers, from which the stream comes as a roaring turbid flood, is greater than it can sweep along, and much of its freight is dropped by the way. The bottom of the canyon is a desolate, flood-swept area of rounded bowlders, from 100 to 200 yards broad. The stream channel is continually shifting, and is frequently divided by islands of bowlders, heaped high during some period of flood. Many of the stream channels leading away from Mount Rainier are known to have the characteristics of the one we ascended, and show that the canyons were carved under different conditions from those now prevailing. The principal amount of canyon cutting must have been done before the streams were overloaded with débris contributed by glaciers — that is, the deep dissection of the lower slope of Mount Rainier and of the platform on which it stands must have preceded the Glacial epoch.

After a night's rest in the shelter of the forest, lulled to sleep by the roar of Carbon River in its tumultuous course after its escape from the ice caverns, we climbed the heavily moraine-covered extremity of Carbon Glacier. At night, weary with carrying heavy packs

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over the chaos of stones that cover the glaciers, we slept on a couch of moss beautified with lovely blossoms, almost within the spray of Philo Falls, a cataract of clear icy water that pours into the canyon of Carbon Glacier from snow fields high up on the western wall of the canyon.

I will ask the reader to defer the study of the glaciers until we have made a reconnaissance of the mountain and climbed to its summit, as he will then be better prepared to understand the relation of the glaciers, névés, and other features with which it will be necessary to deal. In this portion of our fireside explorations let us enjoy a summer outing, deferring until later the more serious task of questioning the glaciers.

From Philo Falls we ascended still higher, by following partially snow-filled lanes between the long lateral moraines that have been left by the shrinking of Carbon Glacier, and found three parallel, sharp-crested ridges about a mile long and from 100 to 150 feet high, made of bowlders and stones of all shapes, which record the former positions of the glacier. Along the western border of the oldest and most westerly of these ridges there is a valley, perhaps 100 yards wide, intervening between the abandoned lateral moraine and the western side of the valley, which rises in precipices to forest-covered heights at least 1,000 feet above. Between the morainal ridges there are similar narrow valleys, each of which at the time of our visit, July 15, was deeply snow-covered. The ridges are clothed with spruce and cedar trees, together with a variety of shrubs and flowering annuals. The knolls rising through the snow are gorgeous with flowers. A wealth of purple Bryanthus, resembling purple heather, and of its constant companion, if not near relative, the Cassiope, with white, waxy bells, closely simulating the white heather, make glorious the mossy banks from which the lingering snow has but just

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departed. Acres of meadow land, still soft with snow water and musical with rills and brooks flowing in uncertain courses over the deep, rich turf, are beautiful with lilies, which seemed woven in a cloth of gold about the borders of the lingering snow banks. We are near the upper limit of timber growth, where park-like openings, with thickets of evergreens, give a special charm to the mountain side. The morainal ridge nearest the glacier is forest-covered on its outer slope, while the descent to the glacier is a rough, desolate bank of stones and dirt. The glacier has evidently but recently shrunk away from this ridge, which was formed along its border by stones brought from a bold cliff that rises sheer from the ice a mile upstream. Standing on the morainal ridge overlooking the glacier, one has to the eastward an unobstructed view of the desolate and mostly stone and dirt covered ice. Across the glacier another embankment can be seen, similar to the one on the west, and, like it, recording a recent lowering of the surface of the glacier of about 150 feet. Beyond the glacier are extremely bold and rugged mountains, scantily clothed with forests nearly to their summits. The position of the timber line shows that the bare peaks above are between 8,000 and 9,000 feet high. Looking southward, up the glacier, we have a glimpse into the wild amphitheater in which it has its source. The walls of the great hollow in the mountain side rise in seemingly vertical precipices about 4,000 feet high. Far above is a shining, snow-covered peak, which Willis named the Liberty Cap. It is one of the culminating points of Mount Rainier, but not the actual summit. Its elevation is about 14,300 feet above the sea. Toward the west the view is limited by the forest-covered morainal ridges near at hand and by the precipitous slopes beyond, which lead to a northward-projecting spur of Mount Rainier, known as the Mother Mountains. This, our first view of Mount Rainier near at hand, has

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shown that the valley down which Carbon Glacier flows, as well as the vast amphitheater in which it has its source, is sunk in the flanks of the mountain. To restore the northern slope of the ancient volcano as it existed when the mountain was young we should have to fill the depression in which the glacier lies at least to the height of its bordering ridges. On looking down the glacier we see it descending into a vast gulf bordered by steep mountains, which rise at least 3,000 feet above its bottom. This is the canyon through which the water formed by the melting of the glacier escapes. To restore the mountain this great gulf would also have to be filled. Clearly the traveler in this region is surrounded by the records of mighty changes. Not only does he inquire how the volcanic mountain was formed, but how it is being destroyed. The study of the glaciers will do much toward making clear the manner in which the once smooth slopes have been trenched by radiating valleys, leaving mountain-like ridges between.

Another line of inquiry which we shall find of interest as we advance is suggested by the recent shrinkage of Carbon Glacier. Are all of the glaciers that flow from the mountain wasting away? If we find this to be the case, what climatic changes does it indicate?

From our camp among the morainal ridges by the side of Carbon Glacier we made several side trips, each of which was crowded with observations of interest. One of these excursions, made by Mr. Smith and myself, was up the snow fields near camp; past the prominent outstanding pinnacles known as the Guardian Rocks, one red and the other black; and through Spray Park, with its thousands of groves of spire-like evergreens, with flower-enameled glades between. On the bare, rocky shoulder of the mountain, where the trees now grow, we found the unmistakable grooves and striations left by former glaciers. The lines engraved in the rock lead away from the

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mountain, showing that even the boldest ridges were formerly ice-covered. Our route took us around the head of the deep canyon through which flows Cataract Creek. In making this circuit we followed a rugged saw-tooth crest, and had some interesting rock-climbing. Finally, the sharp divide between Cataract Creek and a small stream flowing westward to Crater Lake was reached, and a slide on a steep snow slope took us quickly down to where the flowers made a border of purple and gold about the margins of the snow. Soon we were in the forest, and gaining a rocky ledge among the trees, could look down on Crater Lake, deeply sunk in shaggy mountains which still preserve all of their primitive freshness and beauty. Snow lay in deep drifts beneath the shelter of the forest, and the lake was ice-covered except for a few feet near the margin. This was on July 20. I have been informed that the lake is usually free of ice before this date, but the winter preceding our visit was of more than usual severity, the snowfall being heavy, and the coming of summer was therefore much delayed.

The name Crater Lake implies that its waters occupy a volcanic crater. Willis states that Nature has here placed an emerald seal on one of Pluto's sally ports; but that the great depression now water-filled is a volcanic crater is not so apparent as we might expect. The basin is in volcanic rock, but none of the characteristics of a crater due to volcanic explosions can be recognized. The rocks, so far as I saw them, are massive lavas, and not fragmental scoriæ or other products of explosive eruptions. On the bold, rounded rock ledges down which we climbed in order to reach the shore, there were deep glacial scorings, showing that the basin was once deeply filled with moving ice. My observations were not sufficiently extended to enable me to form an opinion as to the origin of the remarkable depression, but whatever may have been

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its earlier history, it has certainly been profoundly modified by ice erosion.

Following the lake shore southward, groping our way beneath the thick, drooping branches which dip in the lake, we reached the notch in the rim of the basin through which the waters escape and start on their journey to Mowich River and thence to the sea. We there found the branch of the Willis trail leading to Spray Park, and turned toward camp. Again we enjoyed the luxury of following a winding pathway through silent colonnades formed by the moss-grown trunks of noble trees. On either side of the trail worn in the brown soil the ferns and flowering shrubs were bent over in graceful curves, and at times filled the little-used lane, first traversed fifteen years before.

The trail led us to Eagle Cliff, a bold, rocky promontory rising as does El Capitan from the Yosemite, 1,800 feet from the forest-lined canyon of Mowich River. From Eagle Cliff one beholds the most magnificent view that is to be had in all the wonderful region about Mount Rainier. The scene beheld on looking eastward toward the mighty mountain is remarkable alike for its magnificence and for the artistic grouping of the various features of the sublime picture. In the vast depths at one's feet the tree-tops, through which the mists from neighboring cataracts are drifting, impart a somber tone and make the valley's bottom seem far more remote than it is. The sides of the canyon are formed by prominent serrate ridges, leading upward to the shining snow fields of the mighty dome that heads the valley. Nine thousand feet above our station rose the pure white Liberty Cap, the crowning glory of the mountain as seen from the northward. The snow descending the northwest side of the great central dome is gathered between the ridges forming the sides of the valley, and forms a white névé from which flows Willis Glacier. In looking up the valley from Eagle Cliff the entire extent of the snow fields

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and of the river-like stream of ice flowing from them is in full view. The ice ends in a dirt-covered and rock-strewn terminus, just above a huge rounded dome that rises in its path. In 1881 the ice reached nearly to the top of the dome and broke off in an ice cliff, the detached blocks falling into the gulf below. The glacier has now withdrawn its terminus well above the precipice where it formerly fell as an ice cascade, and its surface has shrunk away from well-defined moraines in much the same manner as has already been noted in the case of Carbon Glacier. A more detailed account of the retreat of the extremity of Willis Glacier [1] will be given later.

From Eagle Cliff we continued our tramp eastward along the trail leading to Spray Park, climbed the zig-zag pathway up the face of a cliff in front of Spray Falls, and gained the picturesque and beautiful park-like region above. An hour's tramp brought us again near the Guardian Rocks. A swift descent down the even snow fields enabled us to reach camp just as the shadows of evening were gathering in the deeper canyons, leaving the silent snow fields above all aglow with reflected sunset tints.

Taking heavy packs on our backs on the morning of July 21, we descended the steep broken surface of the most recent moraine bordering Carbon Glacier in its middle course, and reached the solid blue ice below. Our course led us directly across the glacier, along the lower border of the rapidly melting covering of winter snow. The glacier is there about a mile across. Its central part is higher than its border, and for the most part the ice is concealed by dirt and stones. Just below the névé, however, we found a space about half a mile long in which melting had not led to the concentration of sufficient débris to make traveling difficult. Farther down the glacier, where surface melting was more advanced, the entire glacier, with the exception

[1] Called the North Mowich Glacier on the present map.

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of a few lanes of clear ice between the ill-defined medial moraines, was completely concealed beneath a desolate sheet of angular stones. On reaching the east side of the glacier we were confronted with a wall of clay and stones, the inner slope of a moraine similar in all respects to the one we had descended to reach the west border of the glacier. A little search revealed a locality where a tongue of ice in a slight embayment projected some distance up the wall of morainal material, and a steep climb of 50 or 60 feet brought us to the summit. The glacier has recently shrunk — that is, its surface has been lowered from 80 to 100 feet by melting.

On the east side of the glacier we found several steep, sharp-crested ridges, clothed with forest trees, with narrow, grassy, and flower-strewn dells between, in which banks of snow still lingered. The ridges are composed of bowlders and angular stones of a great variety of sizes and shapes, and are plainly lateral moraines abandoned by the shrinking of the glacier. Choosing a way up one of the narrow lanes, bordered on each side by steep slopes densely covered with trees and shrubs, we found secure footing in the hard granular snow, and soon reached a more open, parklike area, covered with mossy bosses of turf, on which grew a great profusion of brilliant flowers. Before us rose the great cliffs which partially inclose the amphitheater in which Carbon Glacier has its source. These precipices, as already stated, have a height of about 4,000 feet, and are so steep that the snow does not cling to them, but descends in avalanches. Above the cliffs, where the inclination is less precipitous, the snow lies in thick layers, the edges of which are exposed in a vertical precipice rising above the avalanche-swept rock-slope below. Far above, and always the central object in the wild scenery surrounding us, rose the brilliant white Liberty Cap, one of the pinnacles on the rim of the great summit crater. Our way then turned eastward, following the side of the mountain,

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and led us through a region just above the timber line, which commands far reaching views to the wild and rugged mountains to the northeast. This open tract, leading down to groves of spruce trees and diversified by charming lakelets, bears abundant evidence of having formerly been ice-covered, and is known as Moraine Park.

In order to retain our elevation we crossed diagonally the steep snow slopes in the upper portion of the Moraine Park. Midway over the snow we rested at a sharp crest of rock, and found that it is composed of light-colored granite. Later we found that much of the area between the Carbon and Winthrop glaciers is composed of this same kind of rock. Granite forms a portion of the border of the valley through which flow the glaciers just named, and furnished them with much granitic débris, which is carried away as moraines and later worked over into well-rounded bowlders by the streams flowing from the ice. The presence of granite pebbles in the course of Carbon and White rivers, far below the glaciers, is thus accounted for.

A weary tramp of about 4 miles from the camp we had left brought us to the border of Winthrop Glacier. In the highest grove of trees, which are bent down and frequently lie prone on the ground, although still living, we selected a well-sheltered camping-place. Balsam boughs furnished luxuriant beds, and the trees killed by winter storms enabled us to have a roaring camp fire. Fresh trail of mountain goats and their but recently abandoned bed showed that this is a favorite resort for those hardy animals. Marmots were also abundant, and frequently awakened the echoes with their shrill, whistling cries. The elevation of our camp was about 8,000 feet.

From our camp on the cliffs above the west border of Winthrop Glacier we made excursions across that glacier and to its heavily moraine-covered extremity. The snow mantle that is spread over the region about

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Mount Rainier each winter melts first on the rugged plateau surrounding the base of the mountain, and, as the summer's heat increases, gradually withdraws up the mountain sides, but never so as to uncover the more elevated region. The snow line — that is, the position to which the lower border of the mantle of perennial snow withdraws late in summer — has an elevation of about 9,000 feet. The lower margin of the wintry covering is always irregular, however, extending farthest down on the glaciers and retreating highest on the rocks. At the time of our visit the snow had melted off of nearly all the region below our camp, leaving only dirt-stained snow banks in the more completely sheltered recesses and in deeply shaded dells in the adjacent forests. On the glaciers all the region at a greater elevation than our camp was white and free from dirt and stones, while the hard glacial ice was abundantly exposed at lower altitudes and ended in a completely moraine-covered terminus. Above us all was barren, white, and wintry; below lay the flowery vales and grass parks, warm and inviting, leading to the welcome shade of noble forests. Our course led upward into the frozen region.

On leaving the camp on the border of Winthrop Glacier we began our alpine work. There were five in the party selected for the difficult task of scaling Mount Rainier; namely: Willis, Smith, Ainsworth, Williams, and myself. Taking our blankets, a small supply of rations, an alcohol lamp, alpenstocks, a rope 100 feet long to serve as a life line, and a few other articles necessary for traveling above timber line, we began the ascent of Winthrop Glacier early on the morning of July 23. Our route was comparatively easy at the start, but became steeper and steeper as we advanced. The snow was firm and, except for the numerous crevasses, presented no great difficulties to be overcome. In several places the névé rises in domes as if forced up from beneath, but caused in reality

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by bosses of rock over which the glacier flows. These domes are broken by radiating crevasses which intersect in their central portions, leaving pillars and castle-like masses of snow with vertical sides. At one locality, in attempting to pass between two of these shattered domes, we found our way blocked by an impassable crevasse. Considerable time was lost in searching for a practicable upward route, but at length, by making a detour to the right, we found a way which, although steep, allowed us to pass the much crevassed area and gain the sharp ridge of rock which divides the névé snow flowing from the central dome of the mountain, and marks the separation between Winthrop and Emmons glaciers. This prow-like promontory, rising some 500 feet above the glaciers on either hand, we named The Wedge. This is the upward pointing, acute angle of a great V-shaped portion of the lower slope of the mountain, left in bold relief by the erosion of the valleys on either side. As will be described later, there are several of these remnants about the sides of the mountain at the same general horizon, which record a somewhat definite stage in the destruction of the mountain by ice erosion.

On reaching The Wedge we found it an utterly desolate rocky cape in a sea of snow. We were at an altitude of about 10,000 feet, and far above timber. Water was obtained by spreading snow on smooth rocks or on rubber sheets, and allowing it to melt by the heat of the afternoon sun. Coffee was prepared over the alcohol lamp, sheltered from the wind by a bed sheet supported by alpenstocks. After a frugal lunch, we made shelf-like ledges in a steep slope of earth and stones and laid down our blankets for the night. From sheltered nooks amid the rocks, exposed to the full warmth of the declining sun, we had the icy slopes of the main central dome of the mountain in full view and chose what seemed the most favorable route for the morrow's climb.

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Surrounded as we were by the desolation and solitude of barren rocks, on which not even a lichen had taken root, and pure white snow fields, we were much surprised to receive passing visits from several humming-birds which shot past us like winged jewels. They came up the valley occupied by the Emmons Glacier, turned sharply at The Wedge, and went down the way of the Winthrop Glacier. What tempts these children of the sunlight and the flowers into the frozen regions seems a mystery. That the humming-birds are bold explorers was not new to me, for the reason that on several occasions in previous years, while on the snow-covered slopes of Mount St. Elias, far above all vestiges of vegetation, my heart had been gladdened by glimpses of their brilliant plumage.

When the sun declined beyond the great snow-covered dome that towered above us, and the blue shadows crept down the previously dazzling cliffs, the air became cold and a strong wind made our perch on the rocks uncomfortable. Wrapping ourselves in our blankets we slept until the eastern sky began to glow with sunrise tints.

Early on the morning of July 24 [1896] we began the climb of the steep snow slopes leading to the summit of the mountain. Roped together as we had been on the previous day, we slowly worked our way upward, in a tortuous course, in order to avoid the many yawning crevasses. The way was steep and difficult. Some members of the party felt the effects of the rarefied air, and as we lacked experience in true alpine work our progress was slow and laborious. Many of the crevasses that our course crossed were of the nature of faults. Their upper rims stood several feet above their lower margins, and thus added to the difficulty of passing them. Our aim at first was to traverse the névé of Emmons Glacier and gain the less rugged slope bordering it on the south, but the intervening region was greatly broken and, as we found after several

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approaches to it, utterly impassable. The climb presented no special difficulties other than the extreme fatigue incident to climbing steep snow slopes, especially while attached to a life line, and the delays necessitated by frequently turning and retracing our steps in order to get around wide crevasses.

Once while crossing a steep snow slope diagonally, and having a wide crevasse below us, Ainsworth, who was next to the rear of the line, lost his footing and slid down the slope on his back. Unfortunately, at that instant, Williams, who was at the rear of the line, removed his alpenstock from the snow, was overturned by the pull on the line, and shot headfirst down the slope and disappeared over the brink of the crevasse. A strong pull came on the members of the party who were in advance, but our alpenstocks held fast, and before assistance could be extended to the man dangling in midair, he climbed the taut rope and stood unhurt among us once more. The only serious result of the accident was the loss of an alpenstock.

Pressing on toward the dark rim of rock that we could now and then catch glimpses of at the head of the snow slopes and which we knew to be the outer portion of the summit crater, we crossed many frail snow bridges and climbed precipitous slopes, in some of which steps had to be cut. As we neared the summit we met a strong westerly gale that chilled us and benumbed our fingers. At length, weary and faint on account of the rarity of the air, we gained the lower portion of the rim of stones marking the position of the crater. While my companions rested for a few moments in the shelter of the rocks, I pressed on up the rugged slope and gained the top of the rim.

The stones exposed at the summit are bare of snow, possibly on account of the heat from below, and are rounded and their exposed surfaces polished. The smooth, black bowlders shine in the sunlight much the same as the sand-burnished stones in desert regions.

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Here on the mountain's brow, exposed to an almost continuous gale, the rocks have been polished by drifting snow crystals. The prevailing rounded form that the stones present may be the result of weathering, or possibly is due to the manner in which the fragments were ejected from the volcano. My hasty examinations suggested the former explanation.

Descending into the crater, I discovered crevices from which steam was escaping, and on placing my hands on the rocks was rejoiced to find them hot. My companions soon joined me, and we began the exploration of the crater, our aim being to find the least uncomfortable place in which to take refuge from the freezing blast rather than to make scientific discoveries.

The crater that we had entered is one of the smaller and more recent ones in the truncated summit of the peak, and is deeply filled with snow, but the rim is bare and well defined. The steam and heat from the rocks have melted out many caverns beneath the snow. In one of these we found shelter.

The cavern we chose in which to pass the night, although irregular, was about 60 feet long by 40 wide, and had an arched ceiling some 20 feet high. The snow had been melted out from beneath, leaving a roof so thin that a diffused blue light penetrated the chamber. The floor sloped steeply, and on the side toward the center of the crater there was a narrow space between the rocks and the descending roof which led to unexplored depths. As a slide into this forbidding gulf would have been exceedingly uncomfortable, if not serious, our life line was stretched from crag to crag so as to furnish a support and allow us to walk back and forth during the night without danger of slipping. Three arched openings or doorways communicated with other chambers, and through these drafts of cold air were continually blowing. The icy air chilled the vapor rising from the warm rocks and filled the chamber with steam which took on grotesque forms in the uncertain,

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fading light. In the central part of the icy chamber was a pinnacle of rock, from the crevices of which steam was issuing with a low hissing sound. Some of the steam jets were too hot to be comfortable to the ungloved hand. In this uninviting chamber we passed the night. The muffled roar of the gale as it swept over the mountain could be heard in our retreat and made us thankful for the shelter the cavern afforded.

The floor of our cell was too uneven and too steeply inclined to admit of lying down. Throughout the night we leaned against the hot rocks or tramped wearily up and down holding the life line. Cold blasts from the branching ice chambers swept over us. Our clothes were saturated with condensed steam. While one side of the body resting against the rocks would be hot, the strong drafts of air with a freezing temperature chilled the other side. After long hours of intense darkness the dome of snow above us became faintly illuminated, telling that the sun was again shining. After a light breakfast and a cup of tea, prepared over our alcohol lamp, we resumed our exploration, none the worse for the exposures of the night.

Following the inner rim of the crater so as to be sheltered from the gale still blowing steadily from the west, we gained its northern border and climbed to the topmost pinnacle, known as Columbia's Crest. This pinnacle rises about 50 feet above the general level of the irregular rim of the crater, and is the highest point on the mountain. Its elevation, as previously stated, is 14,526 feet.[1]

The magnificent view described by former visitors to this commanding station, which we had hoped would reward our efforts, was concealed beneath a canopy of smoke that covered all of the region about the mountain to a depth of about 10,000 feet. The surface of the layer of smoke was sharply defined, and appeared like an undulating sea surrounding the island on which

[1] Since shown to be 14,408 feet.

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we stood. Far to the northward rose the regular conical summit of Mount Baker, like an isolated sea-girt island. A few of the rugged and more elevated summits, marking the course of the Cascade Mountains, could be discerned to the eastward. The summits of Mount Adams and Mount St. Helens were in plain view and seemingly near at hand. All of the forest-covered region between these elevated summits was blotted out by the dense, heavy layer of smoke, which rose until it met the westerly gale of the upper regions.

During the ascent of Mount Rainier by Emmons and Wilson, previously referred to, more favorable atmospheric conditions prevailed than at the time of my visit, and the region about the base of the mountain was clearly revealed. In describing the view from the summit Emmons says:

> From the northeastern rim of the crater we could look down an unbroken slope of nearly 10,000 feet to the head of the White River, the upper half or two-thirds of which was so steep that one had the feeling of looking over a perpendicular wall. [It was up this slope that the climb briefly described above was made.] The systems of glaciers and the streams which flowed from them lay spread out as on a map at our feet; radiating out in every direction from the central mass, they all with one accord curve to the westward to send their waters down toward Puget Sound or the Lower Columbia. [Attention has already been directed to the westward curvature of the streams from Mount Rainier on reaching the tilted peneplain on which the mountain stands, and the explanation has been suggested that they are consequent streams the direction of which was determined by the original slope of the now deeply dissected plateau.]
>
> Looking to the more distant country, the whole stretch of Puget Sound, seeming like a pretty little lake embowered in green, could be seen in the northwest, beyond which the Olympic Mountains extend out into the Pacific Ocean. The Cascade Mountains, lying dwarfed at our feet, could be traced northward into British Columbia, and southward into Oregon, while above them, at comparatively regular intervals, rose the ghost-like forms of our companion volcanoes. To the eastward the eye ranged for hundreds of miles over chain on chain of mountain ridges, which gradually disappeared in the dim, blue distance.

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In the truncated summit of Mount Rainier there are three craters. The largest one, partially filled by the building of the two others, is the oldest, and has suffered so greatly from subsequent volcanic explosions and erosion that no more than its general outline can be traced. Peak Success and Liberty Cap are prominent points on the rim of what remains of this huge crater. Its diameter, as nearly as can be judged, is about 2½ miles. Within the great crater, in the formation of which the mountain was truncated and, as previously stated, lost fully 2,000 feet of its summit, there are two much smaller and much more recent craters. The larger of these, the one in which we took refuge, is about 300 yards in diameter, and the second, which is an incomplete circle, its rim having been broken by the formation of its more recent companion, is perhaps 200 yards across. The rim of each now partially snow-filled bowl is well defined, and rises steeply from within to a sharp crest. The character of the inner slopes shows that much rocky material has been detached and has fallen into the cavities from which it was ejected. The rock in the crater walls is in fragments and masses, some of them well rounded and probably of the nature of volcanic bombs. In each of the smaller craters there are numerous steam jets. These show that the rock below is still hot, and that water percolating downward is changed to steam. These steam jets evidently indicate the presence of residual heat and not an actual connection with a volcanic center deep below the surface. All the evidence available tends to show that Rainier is an extinct volcano. It belongs, however, to the explosive type of volcanoes, of which Vesuvius is the best-known example, and there is no assurance that its energies may not be reawakened.

In descending we chose the south side of the mountain, knowing from the reports of many excursionists who had ascended the peak from that direction that

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a practicable route could probably be found. Threading our way between numerous crevasses we soon came in sight of a bold, outstanding rock mass, which we judged to be Gibraltar, and succeeded in reaching it with but little difficulty. On gaining the junction of the rock with the snow fields rising above it, we found evidences of a trail, which was soon lost, however, and only served to show that our general course was the right one. A deep, narrow space between the border of Nisqually Glacier and the precipitous side of Gibraltar, from which the snow and ice had been melted by the heat reflected from the cliffs on our left, led us down to a shelf on the lower side of the promontory, which proved a safe and easy way to the crest of a rocky rib on the mountain side which extended far down toward the dark forests in view below.

Gibraltar is a portion of the cone of Rainier built before the explosion which truncated the mountain. It is an outstanding and very prominent rock mass, left in bold relief by the ice excavation which has carved deep valleys on each side. The rock divides the descending névé in the same manner as does The Wedge, and causes a part of the snow drainage to flow to the Cowlitz and the other part to be tributary to the Nisqually Glacier. The rocks forming Gibraltar consist largely of fragments ejected from the crater above, but present a rude stratification due to the presence of lava flows. When seen from the side and at a convenient distance, it is evident that the planes of bedding, if continued upward at the same angle, would reach above the present summit of the mountain. Gibraltar, like The Wedge, and several other secondary peaks on the sides of Mount Rainier, are, as previously explained, the sharp, upward-pointing angles of large V-shaped masses of the original volcanic cone, left in bold relief by the excavation of deep valleys radiating from the central peak. On the backs, so to speak, of these great V-shaped portions of the mountain which

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now seem to rest against the central dome, secondary glaciers, or interglaciers as they may be termed, have excavated valleys and amphitheaters. In the V-shaped mass of which Gibraltar is the apex, a broad amphitheater-like depression has been cut out, leaving a bold cliff above it. The excavation of the amphitheater did not progress far enough up the mountain to cut away the apex of the V-shaped mass, but left it with a precipice on its lower side. This remnant is Gibraltar. An attempt will be made later to describe more fully the process of glacial erosion of a conical mountain, and to show that the secondary topographic features of Mount Rainier are not without system, as they appear at first view, but really result from a process which may be said to have a definite end in view.

Below Gibraltar the descent was easy. Our life line was no longer needed. Tramping in single file over the hard surfaces of the snow field, remnants of the previous winter's snow, we made rapid progress, and about noon gained the scattered groves of spruce trees which form such an attractive feature of Paradise Park.

Fortunately, we found Prof. E. S. Ingraham, of Seattle, and a party of friends, including several ladies, encamped in Paradise Park, and the hospitality of the camp was extended to us. During the afternoon we basked in the warm sunshine, and in the evening gathered about a roaring campfire and enjoyed the society of our companions, who were enthusiastic in their praise of the wonderful scenes about their camp.

The southern side of Mount Rainier is much less precipitous than its northern face, and the open park-like region near timber line is broader, more diversified, and much more easy of access. The general elevation of the park is between 5,000 and 7,000 feet, and it is several thousand acres in extent. Its boundaries are indefinite. It merges into the heavily forested region to the south, and into more alpine regions

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on the side toward the mountain, which towers above it on the north. To the east it is bordered by Cowlitz Glacier, and on the west by Nisqually Glacier. Each of these fine ice rivers descends far below timber line. The small interglacier, known as the Paradise Glacier, may be considered as lying within the limits of the park.

Paradise Park presents many and varied charms. It is a somewhat rugged land, with a deep picturesque valley winding through it. The trees grow in isolated groves. Each bunch of dark-green firs and balsams is a cluster of gracefully tapering spires. The undulating meadows between the shady groves are brilliant in summer with a veritable carpet of gorgeous blossoms. In contrast to the exquisite charms of the groves and flower-decked rolling meadows are desolate ice fields and rugged glaciers which vary, through many tints and shades, from silvery whiteness to intense blue. Added to these minor charms, and towering far above them, is the massive summit of Rainier. At times the sublime mountain appears steel blue in the unclouded sky, or rosy with the afterglow at sunset, or all aflame with the glories of the newborn day. Clouds gather about the lofty summit and transform it into a storm king. Avalanches rushing down its side awaken the echoes in the neighboring forest. The appearance of the mountain is never the same on different days; indeed, it changes its mood and exerts a varying influence on the beholder from hour to hour.

While the central attraction to the lover of mountain scenery in Paradise Park is the vast snow-covered dome of Mount Rainier, there are other mountains in view that merit attention. To the east rises the serrate and rugged Tattoosh range, which is remarkable for the boldness with which its bordering slopes rise from the forested region about it and the angularity of its many serrate summits. This range has never been explored except by miners and hunters, who have

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made no record of their discoveries. It is virgin ground to the geologist and geographer. Distant views suggest that the Tattoosh Mountains have been sculptured from a plateau, probably an upraised peneplain in which there existed a great mass of igneous rock rounded by less resistant Tertiary sediments. The softer rocks have been removed, leaving the harder and more resistant ones in bold relief, to become sculptured by rain and frost into a multitude of angular peaks. This attractive, and as yet unstudied, group of peaks is in plain view from Paradise Park, and may be easily reached from there by a single day's tramp. Many other delightful excursions are open to one who pitches his tent in the alpine meadows on the south side of Mount Rainier.

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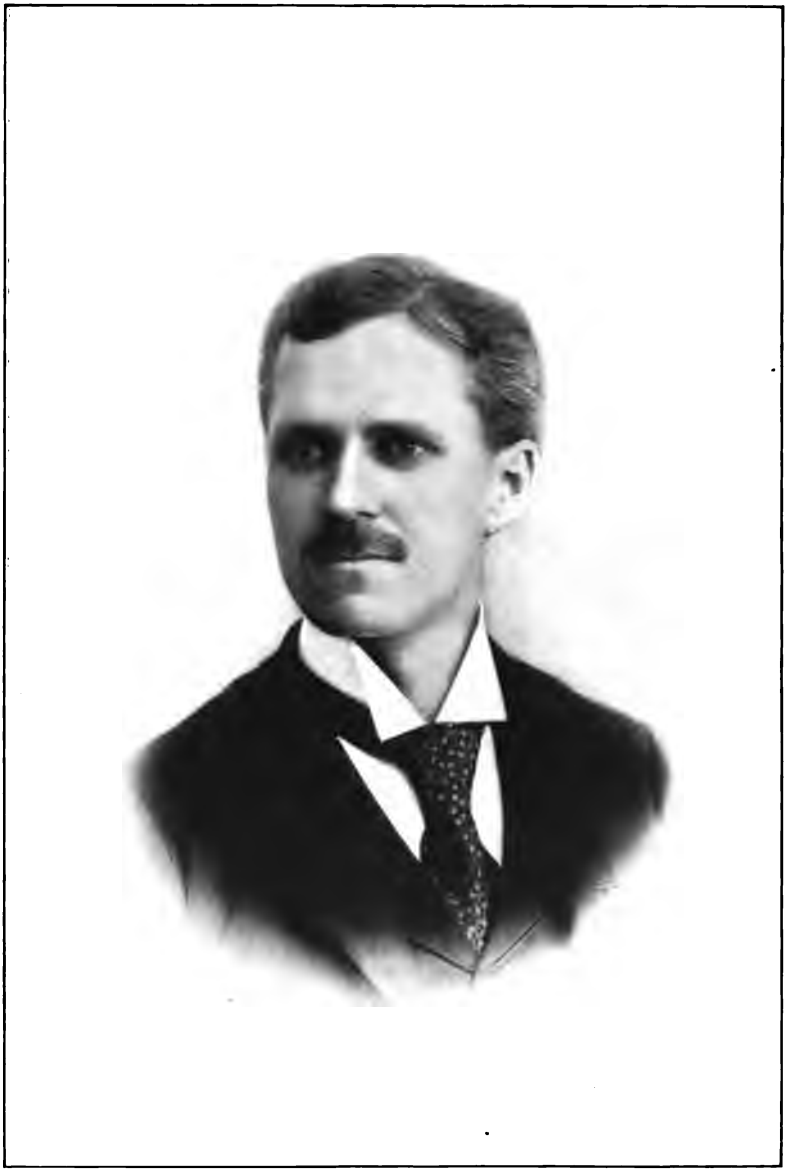

PROFESSOR EDGAR MCCLURE.

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XII. McCLURE'S ACHIEVEMENT AND TRAGIC DEATH, 1897

By HERBERT L. BRUCE and PROFESSOR H. H. McALISTER

Visitors to Paradise Valley, who climb above the Camp of the Clouds to the snowfields, are sure to be attracted to McClure Rock. It is the scene of one of the mountain's earliest tragedies, in which Professor Edgar McClure of the University of Oregon lost his life. He was trying to measure accurately the height of the great mountain as he had already done for Mount Adams and other peaks.

The record of his extensive observations was computed with the greatest care by his colleague, Professor H. H. McAlister of the University of Oregon. An account of the work so tragically ended was prepared by Herbert L. Bruce. Both articles were published in the Seattle Post-Intelligencer for November 7, 1897, from which paper they are here reproduced. The portrait of Professor McClure is furnished by his brother, Horace McClure, editorial writer for the Seattle Daily Times.

The height of the mountain, 14,528 feet, thus obtained, remained in use until 1914, when the United States Geological Survey announced its new and latest findings to be 14,408 feet.

One of the most tragic incidents in modern science was the death of Professor Edgar McClure, who lost his life on Mount Rainier July 27, 1897. Occupying, as he did, the chair of chemistry in the University of Oregon, his personal tastes, instincts and ambitions were essentially scientific. In addition to this he was a member of the Mazamas, whose purposes in the line of scientific exploration have lent a romantic interest and a cumulative value to the geography of the northwest. The particular expedition with which Professor McClure was associated when he met his untimely death, left Portland with the distinct object of making

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the ascent of Mount Rainier, recording such geographical and topographical observations as might be feasible. As a member of the expedition Professor McClure was placed in charge of the elevation department and set before himself a somewhat more distinct and definite purpose, viz., to ascertain by the most approved methods and with the most accurately graduated instruments the precise height of the famous and beautiful mountain. How well he accomplished this purpose will best appear in the subjoined letter from Professor E. H. McAlister, his friend and colleague, who with infinite care and sympathetic zeal has worked out the data, which would otherwise have been undecipherable not only to the general public but to the average scholar. As he himself said when he had completed his arduous task: "I have done everything possible to wring the truth from the observations. In my judgment they should become historic on account of the probability of their great accuracy."

To the accomplishment of this object Professor McClure brought all the varied resources of a ripe culture and an ardent, vigorous young manhood. His plans were all laid with the greatest care. To him their fulfillment meant not so much a personal or selfish triumph as a victory for science. The very instrument on which he most relied for accurate determinations, as will be seen from Professor McAlister's statement, was not only hallowed by scientific associations, but was prepared for its high mission more lovingly and assiduously than a favorite racer would be groomed for the course. Twice had it looked upon the beauties of the Columbia river from the summit of Mount Hood, and on three other lofty peaks it had served its silent but efficient ministry to the cause of science. On one of these, Mount Adams, the altitude determined with this instrument was accepted by the United States government, yet a new tube was filled for it, Professor McClure himself preparing the mercury by distillation,

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and seeing to it that the vacuum was exceptionally perfect. That the barometer was most carefully handled at the time of observation will fully appear from the record below. It was suspended by a ring and allowed to hang until it had assumed the temperature of the surrounding air before being read. Not only this, but all the subsidiary phenomena which could have the slightest bearing on the result were laboriously determined. Concurrent observations were made at all salient surrounding stations, while for a week before the date of actual observation Professor McClure himself had made numerous observations both of pressure and of temperature at various sub-stations in the vicinity of Mount Rainier, and his collaborateur has secured simultaneous observations from Seattle and Portland. Uniting as he did the fervor of the pioneer explorer with the accuracy of the laboratory chemist, Professor McClure was peculiarly fitted to obtain a result which bids fair to become historic.

The broken barometer will appeal powerfully to every lover of science. If, as has been suggested, a monument be reared to mark the spot where the young scientist gave up his life, no fitter design could be adopted than a stone shaft bearing on its face a bas-relief of the historic instrument which he bore on his back with sacred care. It is entirely probable that this barometer, coupled with his unselfish solicitude for the safety of other members of the expedition, was the immediate cause of his death. He carried it in a double case; a wooden one which his own hands had constructed, and outside of this a strong leather tube. From the latter stout thongs enabled him to strap the instrument on his back, much as a pioneer huntsman would wear his trusty rifle. While standing on the perilous ledge whence he took the fatal plunge, he turned to sound warning to his companions whom he was leading in a search for the lost pathway down the mountain. "Don't come down here; it is too steep,"

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he called, turning so as to make his voice more audible. These were his last words. He vanished in the night and the abyss. It is likely that the tube, three and a half feet in length, caught as he turned and helped to hurl him from his precarious footing. Like his own high strung frame, the delicate instrument was shattered; but neither of the twain went away from the world without leaving an imperishable record.

It is interesting to note the close correspondence of his independent observations with those made by others. The height of the mountain had been measured many times before he essayed to measure it. Some observers had measured it by triangulation, and others, notably Major E. S. Ingraham, of Seattle, had given its altitude from the readings of mercurial barometers. Major Ingraham gave the height at 14,524 feet. It will be noticed that the result obtained by Professor McClure was just four feet greater, a remarkable coincidence at that vast altitude and among conditions of hardship, exposure and uncertainty. Prior to Professor McClure's record, the latest measurement of Rainier had been made by George F. Hyde, of the United States Geological Survey, in 1896. He pursued the method of triangulation, and, taking as his base a line at Ellensburg, in connection with the sea level gauge at Tacoma, he figured out the extreme height of Rainier at 14,519 feet.

The value of Professor McClure's determination will be heightened rather than lessened by the peculiar difficulty and rareness of scientific work in an unexplored territory and from a base which has not all the appurtenances and advantages of the older scientific stations of the East and of Europe. In this respect his work is like that of Agassiz and of Audubon. Not unlike those great masters was he in his intense and lofty devotion to science. Not unlike them he wrought with rigid accuracy where others had worked almost at random. Not unlike them he aroused among his

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friends and students the conviction that he was a born high priest of nature, whose chief mission in the world was to reveal her secrets to mankind. He offered up his life virtually a sacrifice to the cause of popular and practical science, and in as lofty a sense as ever dignified a Roman arena he was a martyr to the cause of truth. To use the matchless figure employed by Bryon in describing the death of Henry Kirk White, who died a victim to his own passionate devotion to literary art, he was like the struck eagle whose own feather "winged the shaft that quivered in his heart."

Just in harmony with this thought came countless expressions of sympathy and condolence to the members of Professor McClure's family when the sad news of his death went abroad. One of the most touching, and, to my mind, one of the most typical of all these came from an obscure man in an obscure corner of Kentucky. He was not a great man himself, as the world counts greatness, this man in Kentucky; but he knew a great man when he saw him. He had known Edgar McClure; and when he heard the circumstances of his death he sat down and wrote a brief note. One sentence in it was worthy of Whittier or Emerson. It was this: "Edgar McClure died as he had always lived — on the mountain top."

In transmitting his results to Horace McClure, brother of the deceased scientist, Professor McAlister brings to a proper close a labor of love, one that is as creditable to his scholarly culture as it is to his unselfish and devoted friendship.

HERBERT L. BRUCE.

LETTER OF TRANSMISSION

University of Oregon,
Eugene, Or., October 28, 1897.

MR. HORACE McCLURE — Dear Sir: I herewith transmit to you for publication my report upon the

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observations of your late brother, Professor Edgar McClure, relative to the altitude of Mount Rainier, the data having been referred to me for reduction and computation by yourself and by the officials of the Mazama Club.

It is but just to myself to say that the long delay in the appearance of this report has been caused by unavoidable difficulties in the collection of subsidiary data; in particular, the comparison sheet showing the instrumental error of Professor McClure's barometer could not be found until the 9th of this month, when it was discovered among some effects left by him in Portland. A further delay has been occasioned in obtaining a few other important data. A report approximately correct could have been made some time ago, but I felt it was due to the memory of Professor McClure's reputation for extreme accuracy that no report whatever should be published until I was able to state a result for which I could vouch as being the very best that the observations were capable of affording.

The thanks of all concerned are due to Mr. B. S. Pague, Director of the Oregon Weather Bureau, for numerous courtesies and for his efficient aid in the collection of data.

Very respectfully,

E. H. McALISTER,

Professor of Applied Mathematics.

THE RESULT

For the benefit of those not interested in the scientific details of this report, it may be stated at once that the summit of Mount Rainier, according to Professor McClure's observations, is 14,528 feet above sea level. The altitudes of various sub-stations occupied en route will be found further on. An account of the data, with description of the methods employed in reduction and computation, is given, to indicate the degree of reliance to be placed upon the result.

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The principal observation to which this report refers was made by Professor Edgar McClure, of the University of Oregon, on the summit of Mount Rainier, Washington, July 27, 1897, at 4:30 P.M., Pacific standard time. The observation consists of a reading of Green's standard mercurial barometer, No. 1612, together with readings of attached and detached thermometers. It appears that the barometer, which was suspended by a ring at the top, was allowed so to hang until it had assumed the temperature of the surrounding air, before being read; that the sky was clear at the time; and that the place of observation, the highest on the mountain, is designated as Columbia Crest.

The barometric reading, corrected for instrumental error and temperature, was 17.708 inches; the air temperature was 29 degrees Fahrenheit.

Concurrent observations were made at 9:30 A.M. and hourly during the afternoon by the regular observers at Seattle, Portland, Fort Canby, the University of Oregon at Eugene, Roseburg, and one observation at Walla Walla at 5 P.M.

In addition to these, during the week preceding the 27th Professor McClure made numerous observations both of pressure and temperature at various sub-stations in the vicinity of Mount Rainier, and simultaneous observations are furnished from Seattle and Portland.

At the very outset of the work of reduction it was evident that Eugene and Roseburg were under an area of relatively low barometric pressure on the 27th, representing atmospheric conditions that did not prevail in the region of Mount Rainier. I therefore rejected the observations at both these places, using only those at Seattle, Portland, Fort Canby and Walla Walla. The strategic position of these four points will be seen at once by a glance at the map.

The method followed in making the reduction was, in brief, to deduce from the observations at the four base stations surrounding the mountain the actual

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atmospheric conditions prevailing in the immediate region of the mountain. More specifically, the process consisted in determining the atmospheric pressure and temperature at an imaginary sea level vertically under the mountain, which level I shall subsequently call the "mean base."

In this I was greatly assisted by a careful study of the daily weather charts issued by the government, Mr. Pague having kindly loaned me his official file for July. I thus practically had at my disposal observations from all the important points on the Coast, both before and after the principal observation. With due regard to the position and direction of the isobars, and giving proper weight to the observations at each of the four base stations, I finally deduced 30.130 inches as the value of the pressure at the mean base which best satisfied all the data. It ought to be said, perhaps, that this result does not depend upon my judgment to any appreciable extent, but was legitimately worked out from the observations and isobaric lines.

In determining the mean temperature of the air column extending from the mean base to the summit of the mountain, the observations made by Professor McClure during the previous week in the vicinity were so numerous and well timed as to leave far less than the usual amount of uncertainty. Making due allowance for the moderate elevations of the stations, these observations show clearly that the temperature about the mountain at that time followed that of Seattle very closely, and was also not much different from that of Portland, but departed notably from both the heat of Walla Walla and the low temperature of Fort Canby. Allowing proper weight to these facts, the observations at the base stations, with that of Professor McClure at the summit, gave 49 degrees Fahrenheit as the mean temperature of the air column.

I regard the method of reduction outlined above as possessing decided advantages over any other that

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could be applied to the problem in hand; especially because it admits of using the isobaric charts with great freedom and effectiveness, thereby increasing the reliability of the result to a marked extent.

The reduction made, there remained for the final calculation the following data:

Barometric pressure at the summit of Rainier	17.708 inches
Barometric pressure at mean base	30.130 inches
Mean temperature of air column	49 deg. F.
Latitude of Mount Rainer	46 deg. 48 min.

In making the calculation I used the amplified form of Laplace's formula given in the recent publications of the Smithsonian Institution, with the constants there adopted. Perhaps for the general reader it may be important to remark that this formula, besides the barometric pressures, contains corrections for the temperature of the air column; for latitude, and for the variation of gravity with altitude in its effect on the weight of the mercury in the barometer; for the average humidity of the air; and for the variation of gravity with altitude in its effect on the weight of the air. I used the latest edition of the Smithsonian tables, but afterward verified the result by a numerical solution of the formula — the altitude being, as stated at the beginning, 14,528 feet above sea level.

It should be noted as an evidence of the great care and foresight with which Professor McClure planned his work and the success with which he carried it out, that the result of his observations agrees within nine feet with that obtained by the United States Geological Survey in 1895, using, as we may suppose, the most refined methods of triangulation — the latter estimate being 14,519 feet. In connection with so great an altitude, nine feet is an insignificant quantity, and the close correspondence in the results of the two methods of measurement is truly remarkable. I am not inclined to regard it as accidental, but as due to the most careful work in both cases.

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Having a full knowledge of all the available data, I am perhaps better prepared than anyone else to pass judgment upon the result set forth; and while it would be folly to give a numerical estimate of the probable error, I feel justified in saying that no single barometric determination is ever likely to prove more accurate than this one of Professor McClure's. At any rate, the outstanding error is now too small to justify the hazard of any future attempts.

From the observations made by Professor McClure while en route to the summit, together with simultaneous records from Seattle and Portland, the following altitudes are obtained:

	Feet above Sea Level
Eatonville	870
Kernahan's ranch	1,880
Longmire springs	2,850
Mazama camp	5,932
Camp-No-Camp	12,700
South side Crater Rainier	14,275

The data in these cases were not sufficient to admit an elaborate working-out of the altitude, so that the figures given are to be regarded as rather close approximations, except in the case of Mazama camp, the altitude of which rests upon four observations and is correspondingly reliable.

Professor McClure's barometer had a notable history in mountaineering. To quote the professor's own words:

"It has twice looked upon the beauties of the Columbia river from the summit of Mount Hood. It was the first barometer taken to the top of Mount Hood, and gave the true elevation, 11,225 feet, in place of 17,000 or 18,000 feet previously claimed. This barometric measurement of Mount Hood was made in August, 1867, by a government party under the direction of Lieutenant R. S. Williamson. The second barometric measurement of Mount Hood was made with the same

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instrument in August, 1870, by Professor George H. Collier."

In August, 1891, the barometer was carried by Professor McClure to the summit of Diamond Peak; in August, 1894, by the writer, to the summit of the middle peak of the Three Sisters, in Oregon, giving an altitude of 10,080 feet, not hitherto published; in July, 1895, Professor McClure took it with the Mazamas to Mount Adams, and in July, 1897, to the summit of Mount Rainier.

A new tube was filled and inserted about two years ago, Professor McClure preparing the mercury by distillation and the writer boiling it in the tube. The vacuum was exceptionally perfect. The comparison sheet previously mentioned showed that the instrument on the occasion of its last trip read .005 inch above standard.

In thus completing the labors of Professor McClure, with whom I was so long and so intimately associated, I feel a very melancholy satisfaction. For his sake, I have spared no pains in collecting all the useful data that could be obtained, to make the result reliable to the last degree possible in such a case. I leave that result as a sufficient guarantee of the accuracy of the whole work from beginning to end.

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XIII. FIELD NOTES ON MOUNT RAINIER, 1905

By PROFESSOR HENRY LANDES

HENRY LANDES is Professor of Geology and Dean of the College of Science, University of Washington, and he has also served as State Geologist of Washington, since 1895. He was born at Carroll, Indiana, on December 22, 1867. He graduated from the University of Indiana in 1892 and obtained the Master of Arts degree at Harvard University in 1893. He was assistant to the State Geologist of New Jersey and Principal of the High School at Rockland, Maine, before being elected to his present professorship at the University of Washington in 1895. For a year and a half, 1914–1915, he was Acting President of the University of Washington.

He has published many articles and pamphlets on geological subjects. The one here given appeared in Mazama, published in December, 1905, by the Mazamas in Portland, Oregon. It is reproduced here with the permission of the author and of the mountaineering club.

The Columbia River afforded to the first people who came to Washington and Oregon the easiest and most feasible route across the Cascade Mountains. It was through this gateway that travel passed from one side of the range to the other until the advent of the railways in comparatively recent years. The early travelers along the river who were of an observing or scientific bent, noted that the rocks were, in general, dark, heavy and massive and of the class commonly known as basalt. Here and there a sort of pudding stone or agglomerate was observed, which in some instances might represent a sedimentary deposit, but which here had clearly an igneous origin.

The observations of the early travelers were supplemented later by the further studies of geologists; and from the facts noted along the Columbia River, the

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PROFESSOR HENRY LANDES.

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generalization holds good to a great extent on the Oregon side, but it is by no means true on the Washington side, as has been shown by later studies. Granite rocks are encountered within a few miles of the Columbia River as one travels north along the Cascade Range. Associated with these granite rocks are found rocks of a metamorphic type, such as gneiss, schists, quartzites, crystalline limestone, slate, etc. Such rocks exist south of Mount Rainier, but are not conspicuous. North of this point, however, and throughout all of the northern Cascades they form the great bulk of the rock.

In other words, in the Cascades of Washington, igneous activity has been much more common in the region south of Rainier than in that north of the mountain. When the first observations were made upon the great lava flows of southeastern Washington, which form a part of the greatest lava plain in the world, it was supposed that the lava had its origin in the volcanoes of the Cascades. Later investigations have shown this view to be erroneous. The lava of the plain has come directly from below through great longitudinal fissures instead of through circular openings such as one finds in volcanoes.

It is probable that the Cascades, like most other mountains, have had several different periods of uplift. We have several notable examples of mountains which have had an initial uplift and then have been reduced to base by erosion. By a second upheaval the plain has been converted into a plateau, and this in time assumes a very rugged, mountainous character as a result of the combined forces of air and water. Eventually these same forces would reduce the region to a plain again. Just how many times this thing has happened in the Cascades we do not know. Bailey Willis has shown that in the northern Cascades, at least, the whole country was reduced to a plain prior to the last uplift, which took place in comparatively

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recent times. Out of this plateau, formed by the uplifting of the plain, has arisen through the active attack of erosive forces the truly mountainous character of the district. Erosion has been at the maximum in the mountains because of the heavy precipitation. Precipitation in the high mountains being chiefly in the form of snow has led to the formation of glaciers, producing thereby a rapidity of erosion of the first order. The active work of ice and running water has given to the mountains an extremely rugged appearance, characterized by valleys of great depth extending into the very heart of the mountains and with precipitous divides.

It must be understood that the time consumed in the uplifting of the Cascades, and the conversion from plain to plateau, was of considerable duration. With the beginning of the uplift, the sluggish streams of the plain became rejuvenated, and took up actively once more the work of erosion. By the time the maximum uplift was reached, the plateau had lost to a certain degree its character of extreme levelness. The streams had already entrenched themselves in rather conspicuous valleys. It is believed that the great volcanoes of Washington — Rainier and its associates — began their activities about the time the uplift described above reached its maximum height. In the vicinity of Rainier the rock of the old plateau is granite; and the volcano may be said to be built upon a platform of that material. On the north side of the mountain granite appears conspicuously at a height of about 7,000 feet; while on the south side it appears at points varying from 5,000 to 6,000 feet above the sea.

That the surface of the granite platform was irregular and uneven may be seen in the walls of the Nisqually canyon, near the lower terminus of the glacier. As one ascends the canyon to the glacier, the contact between the lava rock and the granite shows quite plainly on both the right and the left side. On the left the contact

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is at least 1,000 feet above that on the right side. A little way above the lower end of the glacier, on each side of the canyon, a good opportunity presents itself to study the contact of the lava and granite. The granite at this place shows clearly that it was once a land surface; and one may note weathering for a distance downward of seventy-five or one hundred feet. The upper portion of the granite shows the usual characteristics of weathering, namely, the conversion of feldspar into kaolin, the oxidation of iron, etc. At this point the lava overlying the granite is quite basic and massive. The first flow reached a thickness here of fully three hundred feet, and exhibits a fine development of basaltic structure.

In following up the canyon walls one observes that the activity of the volcano for some time was characterized almost exclusively by lava flows. In the main the lava is an andesite, and is very generally of a porphyritic structure. Some of the lava flows were of great extent, and reached points many miles distant from the center of the mountain. While the earlier stages of the activity of the volcano were characterized by lava flows of great thickness, by and by explosive products began to appear, and interbedded with the sheets of lava one finds bombs, lapilli, cinders, etc.

It may be said in general that as the volcano grew in years it changed more and more from eruptions of the quiet type to those of the explosive character. It is plain that a long period of time was consumed in the making of that great volcanic pile, and that the eruptions were by no means continuous. It is clearly shown that after certain outflows of lava, quietude reigned for a time; that at last the surface of the rock became cool and that erosive agents broke it up into great masses of loose stones. In later flows of lava these stones were picked up and cemented into layers of pudding stone, which are styled agglomerates.

Rocks of an agglomerate type are well shown in the

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walls of Gibraltar. This massive pile is largely made up of boulders, great and small, rather loosely held together by a lava cement. The work of frost and ice, expansion and contraction, loosens the boulders readily, and their constant falling from the cliffs gives to this part of the mountain's ascent its dangerous character. While this volcano belongs to a very late period in the history of the earth, it is very clear that there has been no marked activity for many thousands of years. The presence of steam, which is emitted from the hundreds of small openings about the crater, undoubtedly shows the presence of heated rock at no great distance below the surface. Rock is a poor conductor, however, and cooling takes place with very great slowness after a depth of comparatively few feet is reached.

Like most volcanoes, the composite character of the cone is shown on Mount Rainier. After a certain height is reached in the building up of a cone, the rising lava in the throat, or the explosive activities within, sometimes produce an opening through the walls of the cone, and a new outlet to the surface is formed. This often gives the volcano a sort of hummocky or warty appearance, and produces a departure from the symmetrical character. In the case of Rainier it seems to the writer that upon the summit four distinct craters, or outlets, are distinguishable. The first crater reached by the usual route of ascent is the largest one, and may be styled the East crater. It is nearly circular in outline, with a diameter of about one-half mile. Its walls are bare of snow for nearly the whole of its circumference, but the pit is filled with snow and ice. Going across the crater to the westward, one passes over what is really the highest point on the mountain, and then goes down into a smaller crater, or the West crater. This is similar in character and outline to its neighbor, but here the many jets of issuing steam are much more prominent. At a point a few hundred feet lower on the mountain-side there is a peak known

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as Liberty Cap. A cross-section of the cap is in plain view and shows very clearly that this is a minor cone or local point of eruption. It is made up of rock very similar to the main mass of the mountain; and it is likely that the volcanic activity of the mountain was centered here for some time. Looking directly south from the West crater one sees at a distance of less than a mile another peak which is entirely snow-covered; but which may represent an instance parallel with that of the peak on the north side.

Mount Rainier is so deeply covered with ice and snow that the glacial aspects of the mountain are far more conspicuous than the volcanic ones. The facts about the vulcanism and the history of the growth of the mountain are very difficult to study; and it will be a long time before they are fully known. The glaciers, on the other hand, are very conspicuous, comparatively easy of access, and the many facts concerning their extent, rate of motion, recession, or advance, may be quite readily determined. The glaciers, while very prominent at the present time, were at one time much larger than now. There are many things which go to prove that they formerly reached much farther down the valleys.

From the top of the mountain one may see off to the westward for many miles south of Puget Sound prairies of large size, covering a great many square miles. These prairies represent the plains of gravel derived from the melting glaciers, when these stood in their vicinity. From these points of maximum extension the glaciers have slowly receded to their present position.

That the glaciers are receding at the present time is a matter of common observation. At the lower end of the Nisqually glacier the advancing line of vegetation is about one-fourth mile below the present limit of the ice. It is the opinion of Mr. Longmire that the glacier has retreated about that far since he first came to the

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valley, twenty-five years ago. General Stevens was able to point out several instances of notable shrinkages in the glaciers, especially in the Paradise glacier, since his ascent of the mountain in 1870. It will interest students of glaciers to know that some permanent monuments have been set up at the lower end of the Nisqually glacier; and that arrangements have been made whereby the retreat of the ice may be accurately measured from year to year.

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François Émile Matthes.

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XIV. GLACIERS OF MOUNT RAINIER

By F. E. MATTHES

FRANÇOIS ÉMILE MATTHES was born at Amsterdam, Holland, on March 16, 1874. After pursuing studies in Holland, Switzerland and Germany, he came to the United States in 1891 and graduated from the Massachusetts Institute of Technology in 1895. Since 1896 he has been at work with the United States Geological Survey, mostly in the field of topography. He has been honored by and is a member of many scientific societies. His topographic work on the maps of Yosemite and Mount Rainier National Parks made for him many appreciative friends on the Pacific Coast. His pamphlet on "Mount Rainier and Its Glaciers" was published by the United States Department of the Interior in 1914. He secured consent for its republication in the present work.

The impression still prevails in many quarters that true glaciers, such as are found in the Swiss Alps, do not exist within the confines of the United States, and that to behold one of these rare scenic features one must go to Switzerland, or else to the less accessible Canadian Rockies or the inhospitable Alaskan coast. As a matter of fact, permanent bodies of snow and ice, large enough to deserve the name of glaciers, occur on many of our western mountain chains, notably in the Rocky Mountains, where only recently a national reservation — Glacier National Park — was named for its ice fields; in the Sierra Nevada of California, and farther north, in the Cascade Range. It is on the last-named mountain chain that glaciers especially abound, clustering as a rule in groups about the higher summits of the crest. But this range also supports a series of huge, extinct volcanoes that tower high above its sky line in the form of isolated cones. On

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these the snows lie deepest and the glaciers reach their grandest development. Ice clad from head to foot the year round, these giant peaks have become known the country over as the noblest landmarks of the Pacific Northwest. Foremost among them are Mount Shasta, in California (14,162 feet); Mount Hood, in Oregon (11,225 feet); Mount St. Helens (9,697 feet), Mount Adams (12,307 feet), Mount Rainier (14,408 feet), and Mount Baker (10,730 feet), in the State of Washington.

Easily king of all is Mount Rainier. Almost 250 feet higher than Mount Shasta, its nearest rival in grandeur and in mass, it is overwhelmingly impressive, both by the vastness of its glacial mantle and by the striking sculpture of its cliffs. The total area of its glaciers amounts to no less than 45 square miles, an expanse of ice far exceeding that of any other single peak in the United States. Many of its individual ice streams are between 4 and 6 miles long and vie in magnitude and in splendor with the most boasted glaciers of the Alps. Cascading from the summit in all directions, they radiate like the arms of a great starfish. All reach down to the foot of the mountain and some advance considerably beyond.

As for the plea that these glaciers lie in a scarcely opened, out-of-the-way region, a forbidding wilderness as compared with maturely civilized Switzerland, it no longer has the force it once possessed. Rainier's ice fields can now be reached from Seattle or Tacoma, the two principal cities of western Washington, in a comfortable day's journeying, either by rail or by automobile. The cooling sight of crevassed glaciers and the exhilarating flower-scented air of alpine meadows need no longer be exclusive pleasures, to be gained only by a trip abroad.

Mount Rainier stands on the west edge of the Cascade Range, overlooking the lowlands that stretch to Puget Sound. Seen from Seattle or Tacoma, 60 and

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50 miles distant, respectively, it appears to rise directly from sea level, so insignificant seem the ridges about its base. Yet these ridges themselves are of no mean height. They rise 3,000 to 4,000 feet above the valleys that cut through them, and their crests average 6,000 feet in altitude. Thus at the southwest entrance of the park, in the Nisqually Valley, the elevation above sea level, as determined by accurate spirit leveling, is 2,003 feet, while Mount Wow (Goat Mountain), immediately to the north, rises to an altitude of 6,045 feet. But so colossal are the proportions of the great volcano that they dwarf even mountains of this size and give them the appearance of mere foothills. In the Tatoosh Range Pinnacle Peak is one of the higher summits, 6,562 feet in altitude. That peak rises nearly 4,000 feet above the Nisqually River, which at Longmire has an elevation of 2,700 feet, yet it will be seen that Mount Rainier towers still 7,846 feet higher than Pinnacle Peak.

From the top of the volcano one fairly looks down upon the Tatoosh Range, to the south; upon Mount Wow, to the southwest; upon the Mother Mountains, to the northwest, indeed, upon all the ridges of the Cascade Range. Only Mount Adams, Mount St. Helens, and Mount Hood loom like solitary peaks above the even sky line, while the ridges below this line seem to melt together in one vast, continuous mountain platform. And such a platform, indeed, one should conceive the Cascade Range once to have been. Only it is now thoroughly dissected by profound, ramifying valleys, and has been resolved into a sea of wavelike crests and peaks.

Mount Rainier stands, in round numbers, 10,000 feet high above its immediate base, and covers 100 square miles of territory, or one-third of the area of Mount Rainier National Park. In shape it is not a simple cone tapering to a slender, pointed summit like Fuji Yama, the great volcano of Japan. It is,

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rather, a broadly truncated mass resembling an enormous tree stump with spreading base and irregularly broken top. Its life history has been a varied one. Like all volcanoes, Rainier has built up its cone with the material ejected by its own eruptions — with cinders and bombs (steam-shredded particles and lumps of lava), and with occasional flows of liquid lava that have solidified into layers of hard, basaltic rock. At one time it attained an altitude of not less than 16,000 feet, if one may judge by the steep inclination of the lava and cinder layers visible in its flanks. Then a great explosion followed that destroyed the top part of the mountain, and reduced its height by some 2,000 feet. The volcano was left beheaded, and with a capacious hollow crater, surrounded by a jagged rim.

Later on this great cavity, which measured nearly 3 miles across, from south to north, was filled by two small cinder cones. Successive feeble eruptions added to their height until at last they formed together a low, rounded dome — the eminence that now constitutes the mountain's summit. It rises only about 400 feet above the rim of the old crater, and is an inconspicuous feature, not readily identifiable from all sides as the highest point. In fact, so broad is the mountain's crown that from no point at its base can one see the top. The higher portions of the old crater rim, moreover, rise to elevations within a few hundred feet of the summit, and, especially when viewed from below, stand out boldly as separate peaks that mask and seem to overshadow the central dome. Especially prominent are Peak Success (14,150 feet) on the southwest side, and Liberty Cap (14,112 feet) on the northwest side.

The altitude of the main summit has for many years been in doubt. Several figures have been announced from time to time, no two of them in agreement with each other; but all of these, it is to be observed, were

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obtained by more or less approximate methods. In 1913 the United States Geological Survey, in connection with its topographic surveys of the Mount Rainier National Park, was able to make a new series of measurements by triangulation methods at close range. These give the peak an elevation of 14,408 feet, thus placing it near the top of the list of high summits of the United States. This last figure, it should be added, is not likely to be in error by more than a foot or two and may with some confidence be regarded as final. Greater exactness of determination is scarcely practicable in the case of Mount Rainier, as its highest summit consists actually of a mound of snow the height of which naturally varies somewhat with the seasons and from year to year.

This crowning snow mound, which was once supposed to be the highest point in the United States, still bears the proud name of Columbia Crest. It is essentially a huge snowdrift or snow dune, heaped up by the westerly winds. Driving furiously up through the great breach in the west flank of the mountain, between Peak Success and Liberty Cap, they eddy lightly as they shoot over the summit and there deposit their load of snow.

The drift is situated at the point where the rims of the two summit craters touch, and represents the only permanent snow mass on these rims, for some of the internal heat of the volcano still remains and suffices to keep these rock-crowned curving ridges bare of snow the better part of the year. It is intense enough, even, to produce numerous steam jets along the inner face of the rim of the east crater, which appears to be the most recently formed of the two. The center of this depression, however, is filled with snow, so that it has the appearance of a shallow, white-floored bowl some 1,200 feet in diameter. Great caverns are melted out by the steam jets under the edges of the snow mass, and these caverns afford shelters which, though unin-

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viting, are not to be despised. They have proved a blessing to more than one party that has found itself compelled to remain overnight on the summit, saving them from death in the icy gales.

That Mount Rainier should still retain so much of its internal heat is not surprising in view of the recency of its eruptions. It is known to have been active at intervals during the last century, and actual record exists of slight eruptions in 1843, 1854, 1858, and 1870. Indian legends mention a great cataclysmal outburst at an earlier period.

At present the volcano may be regarded as dormant and no apprehension need be felt as to the possibility of an early renewal of its activity. The steam jets in the summit crater, it is true, as well as the hot springs at the mountain's foot (Longmire Springs), attest the continued presence of subterranean fires, but they are only feeble evidences as compared with the geysers, the steam jets, and the hot springs of the Yellowstone National Park. Yet that region is not considered any less safe to visit because of the presence of these thermal phenomena.

In spite of Mount Rainier's continued activity until within the memory of man its sides appear to have been snow clad for a considerable length of time. Indeed, so intense and so long-continued has been the eroding action of the ice that the cone is now deeply ice-scarred and furrowed. Most of its outer layers, in fact, appear already to have been stripped away. Here and there portions of them remain standing on the mountain's flanks in the form of sharp-crested crags and ridges, and from these one may roughly surmise the original dimensions of the cone. Mere details in the volcano's sculpture, these residual masses are, some of them, so tall that, were they standing among ordinary mountains, they would be reckoned as great peaks. Particularly noteworthy is Little Tahoma, a sharp, triangular tooth on the east flank,

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that rises to an elevation of 11,117 feet. In its steep, ice-carved walls one may trace ascending volcanic strata aggregating 2,000 feet in thickness that point upward to the place of their origin, the former summit of the mountain, which rose almost half a mile higher than the present top.

Nor is the great crater rim left by the explosion that carried off the original summit preserved in its entirety. Peak Success and Liberty Cap are the only two promontories that give trustworthy indication of its former height and strength. Probably they represent the more massive portions on the southwest and northwest sides, respectively, while the weaker portions to the east and south have long since crumbled away under the heavy ice cascades that have been overriding them for ages. Only a few small rocky points remain upon which the snows split in their descent. The most prominent, as well as the most interesting, is the one on the southeast side, popularly known as Gibraltar Rock. Really a narrow, wedge-shaped mass, it appears in profile like a massive, square-cut promontory. The trail to the summit of the mountain passes along its overhanging south face and then ascends by a precipitous chute between ice and rock. It is this part of the ascent that is reputed as the most precarious and hazardous.

From the rim points downward the ice cover of the cone divides into a number of distinct stream-like tongues or glaciers, each sunk in a great hollow pathway of its own. Between these ice-worn trenches the uneroded portions of the cone stand out in high relief, forming as a rule huge triangular "wedges," heading at the sharp rim points and spreading thence downward to the mountain's base. There they assume the aspect of more gently sloping, grassy tablelands, the charming alpine meadows of which Paradise Park and Spray Park are the most famous. Separating these upland parks are the profound ice-cut

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canyons which, beyond the glacier ends, widen out into densely forested valleys, each containing a swift-flowing river. No less than a dozen of these ice-fed torrents radiate from the volcano in all directions, while numerous lesser streams course from the snow fields between the glaciers.

Thus the cone of Mount Rainier is seen to be dissected from its summit to its foot. Sculptured by its own glacier mantle, its slopes have become diversified with a fretwork of ridges, peaks, and canyons.

The first ice one meets on approaching the mountain from Longmire Springs lies in the upper end of the Nisqually Valley. The wagon road, which up to this point follows the west side of the valley, winding in loops and curves along the heavily wooded mountain flank, here ventures out upon the rough bowlder bed of the Nisqually River and crosses the foaming torrent on a picturesque wooden bridge. A scant thousand feet above this structure, blocking the valley to a height of some 400 feet, looms a huge shapeless pile of what seems at first sight only rock débris, gray and chocolate in color. It is the dirt-stained end of one of the largest glaciers — the Nisqually. From a yawning cave in its front issues the Nisqually stream, a river full fledged from the start.

The altitude here, it should be noted, is a trifle under 4,000 feet (elevation of bridge is 3,960 feet); hence the ice in view lies more than 10,000 feet below the summit of the mountain, the place of its origin. And in this statement is strikingly summed up the whole nature and economy of a glacier such as the Nisqually.

A glacier is not a mere stationary blanket of snow and ice clinging inert to the mountain flank. It is a slowly moving streamlike body that descends by virtue of its own weight. The upper parts are continually being replenished by fresh snowfalls, which at those high altitudes do not entirely melt away in summer; while the lower end, projecting as it does below the

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snow line, loses annually more by melting than it receives by precipitation, and is maintained only by the continued accession of masses from above. The rate at which the ice advances has been determined by Prof. J. N. Le Conte, of the University of California. In 1903 he placed a row of stakes across the glacier, and with the aid of surveying instruments obtained accurate measurements of the distances through which they moved from day to day. He found that in summer, when the movement is greatest, it averages 16 inches per day. This figure, however, applies only to the central portion of the glacier — the main current, so to speak — for the margins necessarily move more slowly, being retarded by friction against the channel sides.

The snout of the Nisqually Glacier, accordingly, is really composed of slowly advancing ice, but so rapid is the melting at this low altitude that it effectually counterbalances the advance, and thus the ice front remains essentially stationary and apparently fixed in place. Actually, it is subject to slight back and forward movements, amounting to a foot or more per day; for, as one may readily imagine, fluctuations in snowfall and in temperature, above or below the normal, are ever likely to throw the balance one way or another.

A glacier may also make periodic advances or retreats on a larger scale in obedience to climatic changes extending over many years. Thus all the glaciers on Mount Rainier, as well as many in other parts of the world, are at present, and have been for some time, steadily retreating as the result of milder climate or of a lessening in snow supply. Only so recently as 1885 the Nisqually Glacier reached down to the place now occupied by the bridge, and it is safe to say that at that time no engineer would have had the daring to plan the road as it is now laid. In the last 25 years, however, the Nisqually Glacier has retreated fully 1,000 feet.

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Evidences of similar wholesale recession are to be observed at the ends of the other glaciers of Mount Rainier, but the measure of their retreat is not recorded with the precision that was possible in the case of the Nisqually Glacier. Eyewitnesses still live at Longmire Springs who can testify to the former extension of the Nisqually Glacier down to the site of the wagon bridge.

As one continues the ascent by the wagon road a partial view of the glacier's lower course is obtained, and there is gained some idea of its stream-like character. More satisfying are the views from Paradise Park. Here several miles of the ice stream (its total length is nearly 5 miles) lie stretched out at one's feet, while looking up toward the mountain one beholds the tributary ice fields and ice streams, pouring, as it were, from above, from right and left, rent by innumerable crevasses and resembling foaming cascades suddenly crystallized in place. The turmoil of these upper branches may be too confusing to be studied with profit, but the more placid lower course presents a favorable field for observation, and a readily accessible one at that.

A veritable frozen river it seems, flowing between smooth, parallel banks, half a mile apart. Its surface, in contrast to the glistening ice cascades above, has the prevailingly somber tint of old ice, relieved here and there by bright patches of last winter's snow. These lie for the most part in gaping fissures or crevasses that run athwart the glacier at short intervals and divide its body into narrow slices. In the upper course, where the glacier overrides obstacles in its bed, the crevasses are particularly numerous and irregularly spaced, sometimes occurring in two sets intersecting at right angles, and producing square-cut prisms. Farther down the ice stream's current is more sluggish and the crevasses heal up by degrees, providing a united surface, over which one may travel freely.

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Gradually, also, the glacier covers itself with débris. Angular rock fragments, large and small, and quantities of dust, derived from the rock walls bordering the ice stream higher up, litter its surface and hide the color of the ice. At first only a narrow ridge of such material — a moraine, as it is called — accompanies the ice river on each side, resembling a sharp-crested embankment built by human hands to restrain its floods; but toward the lower end of the glacier, as the ice wastes away, the débris contained in it is released in masses, and forms brown marginal bands, fringing the moraines. In fact, from here on down it becomes difficult to tell where the ice of the glacier ends at the sides and where the moraines begin.

The lower part of the glacier also possesses a peculiar feature in the form of a débris ridge about midway on its back — a medial moraine. Most of the way it stretches like a slender, dark ribbon, gradually narrowing upstream. One may trace it with the eye up to its point of origin, the junction of the two main branches of the glacier, at the foot of a sharp rock spur on the mountain's flank.

In the last mile of the Nisqually's course, this medial moraine develops from a mere dirt band to a conspicuous embankment, projecting 40 feet above the ice. Not the entire body of the ridge, however, is made up of rock débris. The feature owes its elevation chiefly to the protective influence of the débris layer on its surface, which is thick enough to shield the ice beneath from the hot rays of the sun, and greatly retards melting, while the adjoining unprotected ice surfaces are rapidly reduced.

A short distance above the glacier's terminus the medial moraine and the ever-broadening marginal bands come together. No more clear ice remains exposed, irregular mounds and ridges of débris cover the entire surface of the glacier, and the moraine-smothered mass assumes the peculiar inchoate appearance that is so striking upon first view.

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In utter contrast with the glacier's dying lower end are the bright snow fields on the summit in which it commences its career. Hard by the rock rim of the east summit crater the snows begin, enwrapping in an even, immaculate layer the smooth sides of the cinder cone. Only a few feet deep at first, they thicken downward by degrees, until, a thousand feet below the crater, they possess sufficient depth and weight to acquire movement. Occasional angular crevasses here interrupt the slope and force the summit-bound traveler to make wearying detours.

Looking down into a gash of this sort one beholds nothing but clean snow, piled in many layers. Only a faint blue tinges the crevasse walls, darkening but slowly with the depth, in contrast to the intense indigo hue characteristic of the partings in the lower course of the glacier. There the material is a dense ice, more or less crystalline in texture; here it is scarcely more than snow, but slightly compacted and loosely granular — what is generally designated by the Swiss term "névé."

For several thousand feet down, as far as the 10,000-foot level, in fact, does the snow retain this granular consistency. One reason for the slowness with which it compacts is found in the low temperatures that prevail at high altitudes and preclude any considerable melting. The air itself seldom rises above the freezing point, even in the middle of the day, and as a consequence the snow never becomes soft and mushy, as it does at lower levels.

When snow assumes the mushy, "wet-sugar" state, it is melting internally as well as at its outer surface, owing both to the water that soaks into it and to the warming of the air inclosed within its innumerable tiny pores (which tiny air spaces, by the way, give the snow its brilliant whiteness). Snow in this condition has, paradoxical though it may sound, a temperature a few tenths of a degree higher than the melting point

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— a fact recently established by delicate temperature measurements made on European glaciers. It is this singular fact, no doubt, that explains how so many minute organisms are able to flourish and propagate in summer on the lower portions of many glaciers. It may be of interest to digress here briefly in order to speak of these little known though common forms of life.

Several species of insects are among the regular inhabitants of glaciers. Most of them belong to a very low order — the Springtails, or *Thysanura* — and are so minute that in spite of their dark color they escape the attention of most passers-by. If one looks closely, however, they may readily be observed hopping about like miniature fleas or wriggling deftly into the cavities of the snow. It seems to incommode them but little if in their acrobatic jumps they occasionally alight in a puddle or in a rill, for they are thickly clad with furry scales that prevent them from getting wet — just as a duck is kept dry by its greasy feathers.

Especially plentiful on the lower parts of the Rainier glaciers, and more readily recognized, are slender dark-brown worms of the genus *Mesenchytraeus*, about 1 inch in length. Millions and millions of them may be seen on favorable days in July and August writhing on the surface of the ice, evidently breeding there and feeding on organic matter blown upon the glacier in the form of dust. So essential to their existence is the chill of the ice that they enter several inches, and sometimes many feet below the surface on days when the sun is particularly hot, reappearing late in the afternoon.

Mention also deserves to be made of that microscopic plant *Protococcus nivalis*, which is responsible for the mysterious pink or light, rose-colored patches so often met with on glaciers — the "red snow" of a former superstition. Each patch represents a colony or culture comprising billions of individuals. It is probable that they represent but a small fraction of the total

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microflora thriving on the snow, the other species remaining invisible for lack of a conspicuous color.

To return to the frigid upper névés, it is not to be supposed that they suffer no loss whatever by melting. The heat radiated directly to them by the sun is alone capable of doing considerable damage, even while the air remains below the freezing point. At these high altitudes the sun heat is astonishingly intense, as more than one uninitiated mountain climber has learned to his sorrow by neglecting to take the customary precaution of blacking his face before making the ascent. In a few hours the skin is literally scorched and begins to blister painfully.

At the foot of the mountain the sun heat is relatively feeble, for much of it is absorbed by the dust and vapor in the lower layers of the atmosphere, but on the summit, which projects 2 miles higher, the air is thin and pure, and lets the rays pass through but little diminished in strength.

The manner in which the sun affects the snow is peculiar and distinctive. Instead of reducing the surface evenly, it melts out many close-set cups and hollows, a foot or more in diameter and separated by sharp spires and crests. No water is visible anywhere, either in rills or in pools, evaporation keeping pace with the reduction. If the sun's action is permitted to continue uninterrupted for many days, as may happen in a hot, dry summer, these snow cups deepen by degrees, until at length they assume the aspect of gigantic bee cells, several feet in depth. Snow fields thus honeycombed may be met with on the slopes above Gibraltar Rock. They are wearisome to traverse, for the ridges and spines are fairly resistant, so that one must laboriously clamber over them. Most exasperating, however, is the going after a snowstorm has filled the honeycombs. Then the traveler, waist deep in mealy snow, is left to flounder haphazard through a hidden labyrinth.

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Of interest in this connection is the great snow cliff immediately west of Gibraltar Rock. Viewed from the foot of that promontory, the sky line of the snow castle fairly bristles with honeycomb spines; while below, in the face of the snow cliff, dark, wavy lines, roughly parallel to the upper surface, repeat its pattern in subdued form. They represent the honeycombs of previous seasons, now buried under many feet of snow, but still traceable by the dust that was imprisoned with them.

The snow cliff west of Gibraltar Rock is of interest also for other reasons. It is the end of a great snow cascade that descends from the rim of the old crater. Several such cascades may be seen on the south side of the mountain, separated by craggy remnants of the crater rim. Above them the summit névés stretch in continuous fields, but from the rim on down, the volcano's slopes are too precipitous to permit a gradual descent, and the névés break into wild cascades and falls. Fully two to three thousand feet they tumble, assembling again in compact, sluggish ice fields on the gentler slopes below.

Of the three cascades that feed the Nisqually Glacier only the central one, it is to be observed, forms a continuous connection between the summit névés and the lower ice fields. The two others, viz. the one next to Gibraltar and the westernmost of the three, terminate in vertical cliffs, over great precipices of rock. From them snow masses detach at intervals and produce thundering avalanches that bound far out over the inclined ice fields below. Especially frequent are the falls from the cliff near Gibraltar. They occur hourly at certain times, but as a rule at periods of one or more days.

From the westernmost cascade avalanches are small and rare. Indeed, as one watches them take place at long intervals throughout a summer one can not but begin to doubt whether they are in themselves really

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sufficient to feed and maintain so extensive an ice field as lies stretched out under them. Surely much more snow must annually melt away from the broad surface of that field, exposed as it lies to the midday sun, than the insignificant avalanches can replace. Were they its only source of supply, the ice field, one feels confident, would soon cease to exist.

The fact is that the ice field in question is not dependent for its support on the avalanches from above. It may receive some contributions to its volume through them, but in reality it is an independent ice body, nourished chiefly by direct snow precipitation from the clouds. And this is true, in large measure, of all the ice fields lying under the ice cascades. The Nisqually Glacier, accordingly, is not to be regarded as composed merely of the cascading névés, reunited and cemented together, but as taking a fresh start at these lower levels. Improbable though this may seem at first, it is nevertheless a fact that is readily explained.

The winter snows on Mount Rainier are heaviest in the vicinity of its base; indeed, the snowfall at those low levels is several times greater than that on the summit. This in itself may seem anomalous. So accustomed is one to think that the snowfall on high mountains increases with the altitude that it seems strange to find a case in which the opposite is true. Yet Mount Rainier stands by no means alone in this regard. The Sierra Nevada and the Andes, the Himalayas and the Alps, all show closely analogous conditions.

In each of these lofty mountain regions the precipitation is known to be heaviest at moderate altitudes, while higher up it decreases markedly. The reason is that the storm clouds — the clouds that carry most of the rain and snow — hang in a zone of only moderate elevation, while higher up the atmosphere contains but little moisture and seldom forms clouds of any great density.

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In the Rainier region the height of the storm clouds is in large measure regulated by the relief of the Cascade Range; for it is really this cooling mountain barrier that compels the moisture-laden winds from the Pacific Ocean to condense and to discharge. It follows that the storm clouds are seldom much elevated above the sky line of the Cascade Mountains; they cling, so to speak, to its crest and ridges, while the cone of Mount Rainier towers high above them into serener skies. Many a day may one look down from the summit, or even from a halfway point, such as Camp Muir (10,062 feet), upon the upper surface of the clouds. Like a layer of fleecy cotton they appear, smothering the lower mountains and enveloping the volcano's base.

Clouds, it is true, are frequently seen gathering about the mountain's crown, usually in the form of a circular cap or hood, precursor of a general storm, but such clouds yield but very little snow.

No accurate measurements have been made of the snowfall at the mountain's foot, but in the Nisqually Valley, at Longmire Springs, the winter snows are known often to exceed 20 feet in depth. The summer heat at this low level (2,762 feet) is, of course, abundantly able to remove all of it, at least by the end of May. But higher up every thousand feet of elevation suffices to prolong appreciably the life of the snowy cover. In Paradise Park, for instance, at altitudes between 5,000 and 6,000 feet, huge snowdrifts encumber the flowering meadows until far into July. Above an altitude of 6,000 feet permanent drifts and snow fields survive in certain favored spots, while at the 7,000-foot level the snow line, properly speaking, is reached. Above this line considerable snow remains regularly from one winter to the next, and extensive ice fields and glaciers exist even without protection from the sun.

It is between the 8,000 and 10,000 foot levels, how-

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ever, that one meets with the conditions most favorable for the development of glaciers. Below this zone the summer heat largely offsets the heavy precipitation, while above it the snowfall itself is relatively scant. Within the belt the annual addition of snow to the ice fields is greater than anywhere else on Mount Rainier. The result is manifest in the arrangement and distribution of the glaciers on the cone. By far the greater number originate in the vicinity of the 10,000-foot level, while those ice streams which cascade from the summit, such as the Nisqually, are in a sense reborn some 4,000 feet lower down.

A striking example of an ice body nourished wholly by the snows falling on the lower slope of Mount Rainier is the Paradise Glacier. In no wise connected with the summit névés, it makes its start at an elevation of less than 9,000 feet. Situated on the spreading slope between the diverging canyons of the Nisqually on the west and of the Cowlitz on the northeast, it constitutes a typical "interglacier," as intermediate ice bodies of this kind are termed.

Its appearance is that of a gently undulating ice field, crevassed only toward its lower edge and remarkably clean throughout. No débris-shedding cliffs rise anywhere along its borders, and this fact, no doubt, largely explains its freedom from morainal accumulations.

The absence of cliffs also implies a lack of protecting shade. Practically the entire expanse of the glacier lies exposed to the full glare of the sun. As a consequence its losses by melting are very heavy, and a single hot summer may visibly diminish the glacier's bulk. Nevertheless it seems to hold its own as well as any other glacier on Mount Rainier, and this ability to recuperate finds its explanation in the exceeding abundance of fresh snows that replenish it every winter.

The Paradise Glacier, however, is not the product wholly of direct precipitation from the clouds. Much

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of its mass is supplied by the wind, and accumulates in the lee of the high ridge to the west, over which the route to Camp Muir and Gibraltar Rock is laid. The westerly gales keep this ridge almost bare of snow, permitting only a few drifts to lodge in sheltered depressions. But east of the ridge there are great eddies in which the snow forms long, smooth slopes that descend several hundred feet to the main body of the glacier. These slopes are particularly inviting to tourists for the delightful "glissades" which they afford. Sitting down on the hard snow at the head of such a slope, one may indulge in an exhilarating glide of amazing swiftness, landing at last safely on the level snows beneath.

The generally smooth and united surface of the Paradise Glacier, it may be added, contributes not a little to its attractiveness as a field for alpine sports. On it one may roam at will without apprehension of lurking peril; indeed one can journey across its entire width, from Paradise Park to the Cowlitz Rocks, without encountering a single dangerous fissure. This general absence of crevasses is accounted for largely by the evenness of the glacier's bed and by its hollow shape, owing to which the snows on all sides press inward and compact the mass in the center. Only toward its frontal margin, where the glacier plunges over an abrupt rock step, as well as in the hump of that part known as Stevens Glacier, is the ice rent by long crevasses and broken into narrow blades. Here it may be wise for the inexperienced not to venture without a competent guide, for the footing is apt to be treacherous, and jumping over crevasses or crossing them by frail snow bridges are feats never accomplished without risk.

In the early part of summer the Paradise Glacier has the appearance of a vast, unbroken snow field, blazing, immaculate, in the sun. But later, as the fresh snows melt away from its surface, grayish patches

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of old crystalline ice develop in places, more especially toward the glacier's lower margin. Day by day these patches expand until, by the end of August, most of the lower ice field has been stripped of its brilliant mantle. Its countenance, once bright and serene, now assumes a grim expression and becomes crisscrossed by a thousand seams, like the visage of an aged man.

Over this roughened surface trickle countless tiny rills which, uniting, form swift rivulets and torrents, indeed veritable river systems on a miniature scale that testify with eloquence to the rapidity with which the sun consumes the snow. Strangely capricious in course are these streamlets, for, while in the main gravitating with the glacier's slope, they are ever likely to be caught and deflected by the numerous seams in the ice. These seams, it should be explained, are lines of former crevasses that have healed again under pressure in the course of the glacier's slow descent. As a rule they inclose a small amount of dirt, and owing to its presence are particularly vulnerable to erosion. Along them the streamlets rapidly intrench themselves — perhaps by virtue of their warmth, what little there is of it, as much as by actual abrasion — and hollow out channels of a freakish sort, here straight and canal-like, there making sharp zigzag turns; again broadening into profound, canoe-shaped pools, or emptying into deeper trenches by little sparkling cataracts, or passing under tiny bridges and tunnels — a veritable toy land carved in ice.

But unfortunately these pretty features are ephemeral, many of them changing from day to day; for, evenings, as the lowering sun withdraws its heat, the melting gradually comes to a halt, and the little streams cease to flow. The soft babbling and gurgling and the often exquisitely melodious tinkle of dripping water in hidden glacial wells are hushed, and the silent frost proceeds to choke up passages and channels, so that next day's waters have to seek new avenues.

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In the region where the new crevasses open the surface drainage comes abruptly to an end. Here gaping chutes of deepest azure entrap the torrents and the waters rush with musical thunder to the interior of the glacier and finally down to its bed.

At its lower border the Paradise Glacier splits into several lobes. The westernmost sends forth the Paradise River, which, turning southwestward, plunges over the Sluiskin Fall (named for the Klickitat Indian who guided Van Trump and Hazard Stevens to the mountain in 1870, when they made the first successful ascent) and runs the length of Paradise Valley. The middle lobe has become known as Stevens Glacier (named for Hazard Stevens) and ends in Stevens Creek, a stream which almost immediately drops over a precipice of some 600 feet — the Fairy Falls — and winds southeastward through rugged Stevens Canyon. The easternmost lobes, known collectively as Williwakas Glacier, send forth two little cascades, which, uniting, form Williwakas Creek. This stream is a tributary of the Cowlitz River, as is Stevens Creek.

Immediately adjoining the Paradise Glacier on the northeast, and not separated from it by any definite barrier, lies the Cowlitz Glacier, one of the stateliest ice streams of Mount Rainier. It flows in a southeasterly direction, and burrows its nose deeply into the forest-covered hills at the mountain's foot. Its upper course consists of two parallel-flowing ice streams, intrenched in profound troughs, which they have enlarged laterally until now only a narrow, ragged crest of rock remains between them, resembling a partition a thousand feet in height. At the upper end of this crest stands Gibraltar Rock.

At the point of confluence of the two branches there begins a long medial moraine that stretches like a black tape the whole length of the lower course. To judge by its position midway on the glacier's back, the two tributaries must be very nearly equal in strength,

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yet, when traced to their sources, they are found to originate in widely different ways. The north branch, named Ingraham Glacier (after Maj. E. S. Ingraham, one of Rainier's foremost pioneers), comes from the névés on the summit; while the south branch heads in a pocket immediately under Gibraltar. No snow comes to it from the summit; hence we can not escape the conclusion that it receives through direct precipitation and through wind drifting about as much snow as its sister branch receives from the summit regions. Like the glacier troughs below, the pocket appears to have widened laterally under the influence of the ice, and is now separated from the Nisqually ice fields to the west by only a narrow rock partition, the Cowlitz Cleaver, as it is locally called. Up this narrow crest the route to Gibraltar Rock ascends. The name "cleaver," it may be said in passing, is most apt for the designation of a narrow rock crest of this sort, and well deserves to be more generally used in the place of awkward foreign terms, such as arrete and grat.

Both branches of the Cowlitz Glacier cascade steeply immediately above their confluence, but the lower glacier has a gentle gradient and a fairly uneventful course. Like the lower Nisqually, it is bordered by long morainal ridges, and toward its end acquires broad marginal dirt bands. For nearly a mile these continue, leaving a gradually narrowing lane of clear ice between them. Then they coalesce and the whole ice body becomes strewn with rock débris.

The Cowlitz Glacier, including its north branch, the Ingraham Glacier, measures slightly over 6 miles in length. Throughout that distance the ice stream lies sunk in a steep-walled canyon of its own carving. Imposing cliffs of columnar basalt, ribbed as if draped in corduroy, overlook its lower course. Slender waterfalls glide down their precipitous fronts, like silver threads, guided by the basalt flutings.

From the end of the glacier issues the Muddy Fork

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of the Cowlitz River, which, joining the Ohanapecosh, forms the Cowlitz River proper, one of the largest streams of the Cascade Range. For nearly a hundred miles the Cowlitz River follows a southwesterly course, finally emptying in the Columbia River a short distance below Portland, Oregon.

The name Muddy Fork is a most apt one, for the stream leaves the glacier heavily charged with débris and mud, and while it gradually clears itself as it proceeds over its gravelly bed, it is still turbid when it reaches the Ohanapecosh. That stream is relatively clear, for it heads in a glacier of small extent and little eroding power, and consequently begins its career with but a moderate load; furthermore it receives on its long circuitous course a number of tributaries from the Cascade Range, all of them containing clear water.

The name Muddy, however, might with equal appropriateness be given to every one of the streams flowing from the ice fields of Mount Rainier. So easily disintegrated are the volcanic materials of which that peak is composed, that the glaciers are enabled to erode with great rapidity, even in their present shrunken state. They consequently deliver to the streams vast quantities of débris, much of it in the form of cobbles and bowlders, but much of it also in the form of "rock flour."

A considerable proportion of a glacier's erosional work is performed by abrasion or grinding, its bed being scoured and grooved by the rock blocks and smaller débris held by the passing ice. As a result glacier streams ordinarily carry much finely comminuted rock, or rock flour, and this, because of its fineness, remains long in suspension and imparts to the water a distinctive color. In regions of light-colored rocks the glacier streams have a characteristic milky hue, which, as it fades out, passes over into a delicate turquoise tint. But the lavas of Mount Rainier produce for the most part dark-hued flour, and

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as a consequence the rivers coming from that peak are dyed a somber chocolate brown.

A word may not be out of place here about the sharp daily fluctuations of the ice-fed rivers of the Mount Rainier National Park, especially in view of the difficulties these streams present to crossing. There are fully a score of turbulent rivers radiating from the peak, and as a consequence one can not journey far through the park without being obliged to cross one of them. On all the permanent trails substantial bridges obviate the difficulty, but in the less developed portions of the park, fording is still the only method available. It is well to bear in mind that these rivers, being nourished by melting snow, differ greatly in habit from streams in countries where glaciers are absent. Generally speaking, they are highest in summer and lowest in winter; also, since their flow is intimately dependent upon the quantity of snow being melted at a given time, it follows that in summer when the sun reaches its greatest power they swell daily to a prodigious volume, reaching a maximum in the afternoon, while during the night and early morning hours they again ebb to a relatively moderate size. In the forenoon of a warm summer day one may watch them grow hourly in volume and in violence, until toward the middle of the day they become raging torrents of liquid mud in which heavy cobbles and even bowlders may be heard booming as they roll before the current. It would be nothing short of folly to attempt to ford under these conditions, whether on horseback or on foot. In the evening, however, and still better, in the early morning, one may cross with safety; the streams then have the appearance of mere mountain brooks wandering harmlessly over broad bowlder beds.

High above the Ingraham Glacier towers that sharp, residual mass of lava strata known as Little Tahoma (11,117 feet), the highest outstanding eminence on the flank of Mount Rainier. It forms a gigantic "wedge"

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that divides the Ingraham from the Emmons Glacier to the north. So extensive is this wedge that it carries on its back several large ice fields and interglaciers, some of which, lying far from the beaten path of the tourist, are as yet unnamed. Separating them from each other are various attenuated, pinnacled crests, all of them subordinate to a main backbone that runs eastward some 6 miles and terminates in the Cowlitz Chimneys (7,607 feet), a group of tall rock towers that dominate the landscape on the east side of Mount Rainier.

Most of the ice fields, naturally, lie on the shady north slope of the main backbone; in fact, a series of them extends as far east as the Cowlitz Chimneys. One of the lesser crests, however, that running southeastward to the upland region known as Cowlitz Park, also gives protection to an ice body of some magnitude, the Ohanapecosh Glacier. Considerably broader than it is long in the direction of its flow, this glacier lies on a high shelf a mile and a half across, whence it cascades down into the head of a walled-in canyon. Formerly, no doubt, it more than filled this canyon, but now it sends down only a shrunken lobe. The stream that issues from it, the Ohanapecosh River, is really the main prong and head of the Cowlitz River.

The largest and most elevated of the ice fields east of Little Tahoma is known for its peculiar shape as Fryingpan Glacier. It covers fully 3 square miles of ground and constitutes the most extensive and most beautiful interglacier on Mount Rainier. It originates in the hollow east side of Little Tahoma itself and descends rapidly northward, overlooking the great Emmons Glacier and finally reaching down almost to its level. It is not a long time since the two ice bodies were confluent.

The eastern portion of the Fryingpan Glacier drains northeastward and sends forth several cascading torrents which, uniting with others coming from the lesser

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ice fields to the east, form the Fryingpan River, a brisk stream that joins White River several miles farther north.

Below the Fryingpan Glacier there lies a region of charming flower-dotted meadows named Summerland, a most attractive spot for camping.

Cloaking almost the entire east side of Mount Rainier is the Emmons Glacier, the most extensive ice stream on the peak (named after Samuel F. Emmons, the geologist and mountaineer who was the second to conquer the peak in 1870). About 5½ miles long and 1¾ miles wide in its upper half, it covers almost 8 square miles of territory. It makes a continuous descent from the summit to the base, the rim of the old crater having almost completely broken down under its heavy névé cascades. But two small remnants of the rim still protrude through the ice and divide it into three cascades. From each of these dark rock islands trails a long medial moraine that extends in an ever-broadening band down to the foot of the glacier.

Conspicuous lateral moraines accompany the ice stream on each side. There are several parallel ridges of this sort, disposed in successive tiers above each other on the valley sides. Most impressively do they attest the extent of the Emmons Glacier's recent shrinking. The youngest moraine, fresh looking as if deposited only yesterday, lies but 50 feet above the glacier's surface and a scant 100 feet distant from its edge; the older ridges, subdued in outline, and already tinged with verdure, lie several hundred feet higher on the slope.

The Emmons Glacier, like the Nisqually and the Cowlitz, becomes densely littered with morainal débris at its lower end, maintaining, however, for a considerable distance a central lane of clear ice. The stream which it sends forth, White River, is the largest of all the ice-fed streams radiating from the peak. It flows northward and then turns in a northwesterly

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direction, emptying finally in Puget Sound at the city of Seattle.

On the northeast side of the mountain, descending from the same high névés as the Emmons Glacier, is the Winthrop Glacier. Not until halfway down, at an elevation of about 10,000 feet, does it detach itself as a separate ice stream. The division takes place at the apex of that great triangular interspace so aptly named "the Wedge." Upon its sharp cliff edge, Steamboat Prow, the descending névés part, it has been said, like swift-flowing waters upon the dividing bow of a ship at anchor. The simile is an excellent one; even the long foam crest, rising along the ship's side, is represented by a wave of ice.

Undoubtedly the Wedge formerly headed much higher up on the mountain's flank. Perhaps it extended upward in the form of a long, attenuated "cleaver." It is easy to see how the ice masses impinging upon it have reduced it to successively lower levels. They are still unrelentingly at work. It is on the back of the Wedge, it may be added here, that is situated that small ice body which Maj. Ingraham named the "Interglacier." That name has since been applied in a generic sense to all similar ice bodies lying on the backs of "wedges."

Of greatest interest on the Winthrop Glacier are the ice cascades and domes. Evidently the glacier's bed is a very uneven one, giving rise to falls and pools, such as one observes in a turbulent trout stream. The cascades explain themselves readily enough, but the domes require a word of interpretation. They are underlain by rounded bosses of especially resistant rock. Over these the ice is lifted, much as is the water of a swift mountain torrent over submerged bowlders. Immediately above each obstruction the ice appears compact and free from crevasses, but as it reaches the top and begins to pour over it breaks, and a network of intersecting cracks divides it into

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erect, angular blocks and fantastic obelisks. Below each dome there is, as a rule, a deep hollow partly inclosed by trailing ice ridges, analogous to the whirling eddy that occurs normally below a bowlder in a brook. Thus does a glacier simulate a stream of water even in its minor details.

The domes of the Winthrop Glacier measure 50 to 60 feet in height. A sample of the kind of obstruction that produces them appears, as if specially provided to satisfy human curiosity, near the terminus of the glacier. There one may see, close to the west wall of the troughlike bed, a projecting rock mass, rounded and smoothly polished, over which the glacier rode but a short time ago.

Another feature of interest sometimes met with on the Winthrop Glacier, and for that matter also on the other ice streams of Mount Rainier, are the "glacier tables." These consist of slabs of rock mounted each on a pedestal of snow and producing the effect of huge toadstools. The slabs are always of large size, while the pedestals vary from a few inches to several feet in height.

The origin of the rocks may be traced to cliffs of incoherent volcanic materials that disintegrate under the frequent alternations of frost and thaw and send down periodic rock avalanches, the larger fragments of which bound out far upon the glacier's surface.

The snow immediately under these large fragments is effectually protected from the sun and does not melt, while the surrounding snow, being unprotected, is constantly wasting away, often at the rate of several inches per day. Thus in time each rock is left poised on a column of its own conserving. There is, however, a limit to the height which such a column can attain, for as soon as it begins to exceed a certain height the protecting shadow of the capping stone no longer reaches down to the base of the pedestal and the slanting rays of the sun soon undermine it. More

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commonly, however, the south side of the column becomes softened both by heat transmitted from the sun-warmed south edge of the stone, as well as by heat reflected from the surrounding glacier surface, and as a consequence the table begins to tilt. On very hot days, in fact, the inclination of the table keeps pace with the progress of the sun, much after the manner of a sun-loving flower, the slant being to the southeast in the forenoon and to the southwest in the afternoon. As the snow pillar increases in height it becomes more and more exposed and the tilting is accentuated, until at last the rock slides down.

In its new position the slab at once begins to generate a new pedestal, from which in due time it again slides down, and so the process may be repeated several times in the course of a single summer, the rock shifting its location by successive slips an appreciable distance across the glacier in a southerly direction.

As has been stated, the slabs on glacier tables are always of large size. This is not a fortuitous circumstance; rocks under a certain size, and especially fragments of little thickness, cannot produce pedestals; in fact, far from conserving the snow under them, they accelerate its melting and sink below the surface. This is especially true of dark-colored rocks. Objects of dark color, as is well known to physicists, have a faculty for absorbing heat, whereas light-colored objects, especially white ones, reflect it best. Dark-colored fragments of rock lying on a glacier, accordingly, warm rapidly at their upper surface and, if thin, forthwith transmit their heat to the snow under them, causing it to melt much faster than the surrounding clean snow, which, because of its very whiteness, reflects a large percentage of the heat it receives from the sun. As a consequence each small rock fragment and even each separate dust particle on a glacier melts out a tiny well of its own, as a rule not vertically downward but at a slight inclination in the direction of the noonday sun.

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And thus, in some localities, one may behold the apparently incongruous spectacle of large and heavy rocks supported on snow pillars alongside of little fragments that have sunk into the ice.

There is also a limit to the depth which the little wells may attain; as they deepen, the rock fragment at the bottom receives the sun heat each day for a progressively shorter period, until at last it receives so little that its rate of sinking becomes less than that of the melting glacier surface. Nevertheless it will be clear that the presence of scattered rock débris on a glacier must greatly augment the rate of melting, as it fairly honeycombs the ice and increases the number of melting surfaces. Wherever the débris is dense, on the other hand, and accumulates on the glacier in a heavy layer, its effect becomes a protective one and surface melting is retarded instead of accelerated. The dirt-covered lower ends of the glaciers of Mount Rainier are thus to be regarded as in a measure preserved by the débris that cloaks them; their life is greatly prolonged by the unsightly garment.

In many ways the most interesting of all the ice streams on Mount Rainier is the Carbon Glacier, the great ice river on the north side, which flows between those two charming natural gardens, Moraine Park and Spray Park. The third glacier in point of length, it heads, curiously, not on the summit, but in a profound, walled-in amphitheater, inset low into the mountain's flank. This amphitheater is what is technically known as a glacial cirque, a horseshoe-shaped basin elaborated by the ice from a deep gash that existed originally in the volcano's side. It has the distinction of being the largest of all the ice-sculptured cirques on Mount Rainier, and one of the grandest in the world. It measures more than a mile and a half in diameter, while its head wall towers a sheer 3,600 feet. So well proportioned is the great hollow, however, and so simple are its outlines that the eye

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finds difficulty in correctly estimating the dimensions. Not until an avalanche breaks from the 300-foot névé cliff above and hurls itself over the precipice with crashing thunder, does one begin to realize the depth of the colossal recess. The falling snow mass is several seconds in descending, and though weighing hundreds of tons, seemingly floats down with the leisureliness of a feather.

These avalanches were once believed to be the authors of the cirque. They were thought to have worn back the head wall little by little, even as a waterfall causes the cliff under it to recede. But the real manner in which glacial cirques evolve is better understood today. It is now known that cirques are produced primarily by the eroding action of the ice masses embedded in them. Slowly creeping forward, these ice masses, shod as they are with débris derived from the encircling cliffs, scour and scoop out their hollow sites, and enlarge and deepen them by degrees. Seconding this work is the rock-splitting action of water freezing in the interstices of the rock walls. This process is particularly effective in the great cleft at the glacier's head, between ice and cliff. This abyss is periodically filled with fresh snows, which freeze to the rock; then, as the glacier moves away, it tears or plucks out the frost-split fragments from the wall. Thus the latter is continually being undercut. The overhanging portions fall down, as decomposition lessens their cohesion, and so the entire cliff recedes.

A glacier, accordingly, may be said, literally, to gnaw headward into the mountain. But, as it does so, it also attacks the cliffs that flank it, and as a consequence, the depression in which it lies tends to widen and to become semicircular in plan. In its greatest perfection a glacial cirque is horseshoe-shaped in outline. The Carbon Glacier's amphitheater, it will be noticed, consists really of two twin cirques, separated by an angular buttress. But this projection, which is the remnant

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of a formerly long spur dividing the original cavity, is fast being eliminated by the undermining process, so that in time the head wall will describe a smooth, uninterrupted horseshoe curve.

In its headward growth the Carbon Glacier, as one may readily observe on the map, has encroached considerably upon the summit platform of the mountain, the massive northwest portion of the crater rim of which Liberty Cap is the highest point. In so doing it has made great inroads upon the névé fields that send down the avalanches, and has reduced this source of supply. On the other hand, by deploying laterally, the glacier has succeeded in capturing part of the névés formerly tributary to the ice fields to the west, and has made good some of the losses due to its headward cutting. But, after all, these are events of relatively slight importance in the glacier's career; for like the lower ice fields of the Nisqually, and like most glaciers on the lower slopes of the mountain, the Carbon Glacier is not wholly dependent upon the summit névés for its supply of ice. The avalanches, imposing though they are, contribute but a minor portion of its total bulk. Most of its mass is derived directly from the low hanging snow clouds, or is blown into the cirque by eddying winds. How abundantly capable these agents are to create large ice bodies at low altitudes is convincingly demonstrated by the extensive névé fields immediately west of the Carbon Glacier, for which the name Russell Glacier has recently been proposed. It is to be noted, however, that these ice fields lie spread out on shelves fairly exposed to sun and wind. How much better adapted for the accumulation of snow is the Carbon Glacier's amphitheater! Not only does it constitute an admirably designed catchment basin for wind-blown snow, but an effective conserver of the névés collecting in it. Opening to the north only, its encircling cliffs thoroughly shield the contained ice mass from the sun. By its very form, moreover, it

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tends to prolong the glacier's life, for the latter lies compactly in the hollow with a relatively small surface exposed to melting. The cirque, therefore, is at once the product of the glacier and its generator and conserver.

Of the lower course of the Carbon Glacier little need here be said, as it does not differ materially from the lower courses of the glaciers already described. It may be mentioned, however, that toward its terminus the glacier makes a steep descent and develops a series of parallel medial moraines and that it reaches down to an elevation of 3,365 feet, almost 600 feet lower than any other ice stream on Mount Rainier. A beautiful cave usually forms at the point of exit of the Carbon River.

West of the profound canyon of the Carbon River, there rises a craggy range which the Indians have named the Mother Mountains. From its narrow backbone one looks down on either side into broadly open, semicircular valley heads. Some drain northward to the Carbon River, some southward to the Mowich River. Encircling them run attenuated rock partitions, surmounted by low, angular peaks; while cutting across their stairwise descending floors are precipitous steps of rock, a hundred feet in height. On the treads lie scattered shallow lakelets, strung together by little silvery brooks trickling in capricious courses.

Most impressive is the basin that lies immediately under the west end of the range. Smoothly rounded like a bowl, it holds in its center an almost circular lake of vivid emerald hue — that mysterious body of water known as Crater Lake. Let it be said at once that this appellation is an unfortunate misnomer. The basin is not of volcanic origin. It lies in lava and other volcanic rocks, to be sure, but these are merely spreading layers of the cone of Mount Rainier. Ice is the agent responsible for the carving of the hollow. It

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was once the cradle of a glacier, and that ice mass, gnawing headward and deploying even as the Carbon Glacier does to-day, enlarged its site into a horseshoe basin, a typical glacial cirque. The lake in the center is a strictly normal feature; many glacial cirques possess such bowls, scooped out by the eroding ice masses from the weaker portions of the rock floor; only it is seldom that such features acquire the symmetry of form exhibited by Crater Lake. The lakelets observed in the neighboring valley heads — all of which are abandoned cirques —are of similar origin.

As for the skeleton character of the dividing crests, it will be readily seen to be the outcome of the headward gnawing of opposing cirques. In some places, even, the deploying process has attenuated the ridges sufficiently to break them through. West of Crater Lake is an instance of a crest that has thus been breached.

It is a significant fact that the empty cirques about the Mother Mountains lie at elevations ranging between 4,500 and 6,000 feet; that is, on an average 5,000 feet lower than the cirques on Mount Rainier which now produce glaciers. Evidently the snow line in glacial times lay at a much lower level than it does to-day, and the ice mantle of Mount Rainier expanded not merely by the forward lengthening of its ice tongues but by the birth of numerous new glaciers about the mountain's foot. The large size of the empty cirques and canyons, moreover, leads one to infer that many of these new glaciers far exceeded in volume the ice streams descending the volcano's sides. The latter, it is true, increased considerably in thickness during glacial times, but not in proportion to the growth of the low-level glaciers. Nor is this surprising in view of the heavy snow falls occurring on the mountain's lower slopes. There is good reason to believe, moreover, that the cool glacial climate resulted in a general lowering of the zone of heaviest snowfall. It

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probably was depressed to levels between 4,000 and 6,000 feet. Not only the cirque glaciers about the Mother Mountains, but all the neighboring ice streams of the glacial epoch originated within this zone, as is indicated by the altitudes of the cirques throughout the adjoining portions of the Cascade Range. By their confluence these ice bodies produced a great system of glaciers that filled all the valleys of this mountain belt and even protruded beyond its western front.

To these extensive valley glaciers the ice flows of Mount Rainier stood in the relation of mere tributaries. They descended from regions of rather scant snowfall, for the peak in those days of frigid climate rose some 10,000 feet above the zone of heaviest snowfall, into atmospheric strata of relative dryness. It may well be, indeed, that it carried then but little more snow upon its summit than it does to-day.

The North Mowich Glacier is the northernmost of the series of ice bodies on the west flank of Mount Rainier. Like the Carbon Glacier, it heads in a cirque at the base of the Liberty Cap massif, fed by direct snow precipitation, by wind drifting, and by avalanches. The cirque is small and shallow, not as capacious even as either of the twin recesses in the Carbon Glacier's amphitheater. As a consequence the ice stream issuing from it is of only moderate volume; nevertheless it attains a length of $3\frac{3}{4}$ miles. This is due in part to the heavy snows that reënforce it throughout its middle course and in part to overflows from the ice fields bordering it on the south. These ice fields, almost extensive enough to be considered a distinct glacier, are separated from the North Mowich Glacier only by a row of pinnacles, the remnants evidently of a narrow rock partition or "cleaver," now demolished by the ice. The lowest and most prominent of the rock spires bears the appropriate name of "The Needle" (7,587 feet).

The débris-covered lower end of the glacier splits

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into two short lobes on a rounded boss in the middle of the channel. This boss, but a short time ago, was overridden by the glacier and then undoubtedly gave rise to an ice dome of the kind so numerous farther up on the North Mowich Glacier and also characteristic of the Winthrop Glacier.

Separated from the ice fields of the North Mowich Glacier by a great triangular ice field (named Edmunds Glacier) lies the South Mowich Glacier, also a cirque-born ice stream, heading against the base of the Liberty Cap massif. It is the shortest of the western glaciers, measuring only a scant 3 miles. Aside from the snows accumulating in its ill-shaped cirque it receives strong reënforcements from its neighbor to the south — the Puyallup Glacier.

Toward its lower end it splits into two unequal lobes, the southernmost of which is by far the longer. Sharp cut rock wedges beyond its front show that when the glacier extended farther down it split again and again.

The north lobe is of interest because the stream that cascades from the Edmunds Glacier runs for a considerable distance under it. In the near future the lobe is likely to recede sufficiently to enable the torrent to pass unhindered by its front.

What especially distinguishes the Puyallup Glacier from its neighbors to the north is the great elevation of its cirque. The Carbon, North Mowich, and South Mowich Glaciers all head at levels of about 10,000 feet. The amphitheater of the Puyallup Glacier, on the contrary, opens a full 2,000 feet higher up. Encircled by a great vertical wall that cuts into the Liberty Cap platform from the south, it has evidently developed through glacial sapping from a hollow of volcanic origin. From this great reservoir the Puyallup Glacier descends by a rather narrow chute. Then it expands again to a width of three-fourths of a mile and sends a portion of its volume to the South Mowich Glacier. In spite of this loss it continues to expand,

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reaching a maximum width of a mile and a total length of 4 miles. No doubt this is accounted for by the heavy snowfalls that replenish it throughout its course.

Its lower end consists of a tortuous ice lobe that describes a beautiful curve, flanked on the north by a vertical lava cliff. A lesser lobe splits off to the south on a wedge of rock.

Immediately south of the elevated amphitheater of the Puyallup Glacier the crater rim of the volcano is breached for a distance of half a mile. Through this gap tumbles a voluminous cascade from the névé fields about the summit, and this cascade, reënforced by a flow from the Puyallup cirque, forms the great Tahoma Glacier, the most impressive ice stream on the southwest side. Separated from its northern neighbor by a rock cleaver of remarkable length and straightness, it flows in a direct course for a distance of 5 miles. Its surface, more than a mile broad in places, is diversified by countless ice falls and cataracts.

A mere row of isolated pinnacles indicates its eastern border, and across the gaps in this row its névés coalesce with those of the South Tahoma Glacier. Farther down the two ice streams abruptly part company and flow in wide detours around a cliff-girt, castellated rock mass — Glacier Island it has been named. The Tahoma Glacier, about a mile above its terminus, spits upon a low, verdant wedge and sends a lobe southward which skirts the walls of this island rock, and at its base meets again the South Tahoma Glacier. From here on the two ice streams merge and form a single densely débris-laden mass, so chaotic in appearance that one would scarcely take it for a glacier. Numerous rivulets course over its dark surface only to disappear in mysterious holes and clefts. Profound, circular kettles filled with muddy water often develop on it during the summer months, and after a brief existence empty themselves again by subglacial passages or by a newly formed crevasse. So abundant is the

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rock débris released by melting that the wind at times whips it up into veritable dust storms.

Beautifully regular moraines accompany the ice mass on both sides, giving clear evidence of its recent shrinking.

The partner of the Tahoma Glacier, known as the South Tahoma Glacier, heads in a profound cirque sculptured in the flanks of the great buttress that culminates in Peak Success (14,150 feet). It is interesting chiefly as an example of a cirque-born glacier, nourished almost exclusively by direct snowfalls from the clouds and by eddying winds. In spite of its position, exposed to the midday sun, it attains a length of nearly 4 miles, a fact which impressively attests the ampleness of its ice supply.

In glacial times the glacier had a much greater volume and rose high enough to override the south half of Glacier Island, as is clearly shown by the glacial grooves and the scattered ice-worn bowlders on that eminence. As the glacier shrank it continued for some time to send a lobe through the gulch in the middle of the island. Even now a portion of this lobe remains, but it no longer connects with the Tahoma Glacier.

An excellent nearby view of the lower cascades of the South Tahoma Glacier may be had from the ice-scarred rock platform west of Pyramid Rock. From that point, as well as from the other heights of [Indian] Henrys Hunting Ground, one may enjoy a panorama of ice and rock such as is seen in only few places on this continent.

East of the South Tahoma Glacier, heading against a great cleaver that descends from Peak Success, lies a triangular ice field, or interglacier, named Pyramid Glacier. It covers a fairly smooth, gently sloping platform underlain by a heavy lava bed, and breaking off at its lower edge in precipitous, columnar cliffs. Into this platform a profound but narrow box canyon has been incised by an ice stream descending from the summit névés east of Peak Success. This is the Kautz Glacier, an ice stream peculiar for its exceeding slender-

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ness. On the map it presents almost a worm-like appearance, heightened perhaps by its strongly sinuous course. In spite of its meager width, which averages about 1,000 feet, the ice stream attains a length of almost 4 miles and descends to an altitude of 4,800 feet. This no doubt is to be attributed in large measure to the protecting influence of the box canyon.

It receives one tributary of importance, the Success Glacier, which heads in a cirque against the flanks of Peak Success. This ice stream supplies probably one-third of the total bulk of the Kautz Glacier, as one may infer from the position of the medial moraine that develops at the point of confluence. In the lower course of the glacier this medial moraine grows in width and height until it assumes the proportions of a massive ridge, occupying about one-third of the breadth of the ice stream's surface.

A singularly fascinating spectacle is that which the moraine-covered lower end of the glacier presents from the heights of Van Trump Park. A full 1,000 feet down one looks upon the ice stream as it curves around a sharp bend in its canyon.

A short distance below the glacier's terminus, the canyon contracts abruptly to a gorge only 300 feet in width. So resistant is the columnar basalt in this locality that the ice has been unable to hew out a wider passage. Not its entire volume, however, was squeezed through the narrow portal; there is abundant evidence showing that in glacial times when the ice stream was more voluminous it overrode the rock buttresses on the west side of the gorge.

The name of P. B. Van Trump, the hardy pioneer climber of Mount Rainier, has been attached to the interglacier situated between the Kautz and the Nisqually Glaciers. This ice body lies on the uneven surface of an extensive wedge that tapers upward to a sharp point — one of the remnants of the old crater rim. A number of small ice fields are distributed on

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this wedge, each ensconced in a hollow inclosed more or less completely by low ridges. By gradually deploying each of these ice bodies has enlarged its site, and thus the dividing ridges have been converted into slender rock walls or cleavers. In many places they have even been completely consumed and the ice fields coalesce. The Van Trump Glacier is the most extensive of these composite ice fields. The rapid melting which it has suffered in the last decades, however, has gone far toward dismembering it; already several small ice strips are threatening to become separated from the main body.

In glacial times the Van Trump Glacier sent forth at least six lobes, most of which converged farther down in the narrow valleys traversing the attractive alpine region now known as Van Trump Park. This upland park owes its scenic charm largely to its manifold glacial features and is diversified by cirques, canyons, lakelets, moraines, and waterfalls.

In the foregoing descriptions the endeavor has been to make clear how widely the glaciers of Mount Rainier differ in character, in situation, and in size. They are not to be conceived as mere ice tongues radiating down the slopes of the volcano from an ice cap on its crown. There is no ice cap, properly speaking, and there has perhaps never been one at any time in the mountain's history, not even during the glacial epochs.

Several of the main ice streams head in the névés gathering about the summit craters, but a larger number originate in profound amphitheaters carved in the mountain's flanks, at levels fully 4,000 feet below the summit. In the general distribution of the glaciers the low temperatures prevailing at high altitudes have, of course, been a controlling factor; nevertheless in many instances their influence has been outbalanced by topographic features favoring local snow accumulation and by the heavy snowfalls occurring on the lower slopes.

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GEORGE OTIS SMITH.

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XV. THE ROCKS OF MOUNT RAINIER

By GEORGE OTIS SMITH

DIRECTOR GEORGE OTIS SMITH of the United States Geological Survey was born at Hodgdon, Maine, on February 22, 1871. He graduated from Colby College in 1893 and obtained his Doctor of Philosophy degree from Johns Hopkins University in 1896. He had begun his geological work in 1893 and from 1896 to 1907 he was assistant geologist and geologist of the United States Geological Survey. Since 1907 he has been director of that important branch of the Government work. He had been studying the rocks of Mount Rainier before he joined Professor Russell in the explorations of 1896. The record of those studies was published at the same time as Professor Russell's report in the Eighteenth Annual Report of the United States Geological Survey for 1896–1897. With his permission the record is here reproduced in full. So far as is known to the present editor it is the most complete study yet published on the rocks of Mount Rainier.

The earliest geological observations on the structure of Mount Rainier were made in 1870 by S. F. Emmons, of the Geological Exploration of the Fortieth Parallel. The rock specimens collected at this time were studied later by Messrs. Hague and Iddings, of the United States Geological Survey.[1] This petrographical study showed that "Mount Rainier is formed almost wholly of hypersthene andesite, with different conditions of groundmass and accompanied by hornblende and olivine in places." The only other petrographical study of these volcanics is that of Mr. K. Oebbeke, of Munich,[2] upon a small collection made on Mount Rainier by Professor Zittel in 1883.

On the reconnaissance trips on the northern and

[1] Am. Jour. Sci., 3d series, Vol. XXVI, 1883, pp. 222–235.
[2] Neues Jahrbuch für Min., etc., Vol. I, 1885, pp. 222–226.

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eastern slopes of Mount Rainier, during the seasons of 1895 and 1896, the writer had opportunity to make some general observations on the rocks of this mountain, and the petrographical material then collected has since been studied. The observations and collections were of necessity limited, both by the reconnaissance character of the examination and by the mantle of snow and ice which covers so large a part of this volcanic cone.

Two classes of rock are to be discussed as occurring on Mount Rainier: the lavas and pyroclastics which compose the volcanic cone and the granitic rocks forming the platform upon which the volcano was built up.

Volcanic Rocks

GEOLOGIC RELATIONS

On Crater Peak a dark line of rock appears above the snow, and here the outer slope of the crater rim is found to be covered with blocks of lava. A black, loose-textured andesite is most abundant, and from its occurrence on the edge of this well-defined crater may be regarded as representing the later eruptions of Rainier. Lower down on the slopes of the mountain opportunities for the study of the structure of the volcanic cone are found in the bold rock masses that mark the apexes of the interglacial areas. Examples of these are Little Tahoma, Gibraltar, Cathedral Rock, the Wedge, and the Guardian Rocks. These remnants of the old surface of the cone, together with the cliffs that bound the lower courses of the glaciers, exhibit the structural relations very well.

Even when viewed from a distance these cliffs and peaks are seen to be composed of bedded material. Projecting ledges interrupt the talus slopes and express differences of hardness in the several beds, while variations in color also indicate separate lava flows and agglomeratic deposits. Gibraltar is thus seen to

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be composed of interbedded lavas and pyroclastics, and on the Wedge a similar alternation is several times repeated, a pink agglomerate being exceptionally striking in appearance.

These lava flows and beds of volcanic ejectamenta thus exposed dip away from the summit at a low angle. The steepest dip observed was in the amphitheater at the head of Carbon Glacier, where in the dividing spur the dip to the northeast is about 30°. Some exceptions in the inclination of the beds were noted on the southeastern slope, where in a few cases the layers are horizontal, or even dip toward the central axis of the cone. In general, however, the volcanics composing Mount Rainier may be said to dip away from the summit at an angle somewhat lower than that of the slopes of the present cone. In the outlying ridges to the north, the Mother Range, Crescent Mountain, and the Sluiskin Mountains, the structure seems to be that of interbedded volcanics approximately horizontal. The extent of the volcanics from the center of eruption has not been determined. Similar lava extends to the south, beyond the Tattoosh Range, and volcanics of similar composition occur to the north, in the Tacoma quadrangle. The latter lavas and tuffs may have originated from smaller and less important cones, now destroyed by erosion.

A radial dike was observed at only one locality, near the base of Little Tahoma. In several cases the lava masses, as seen in cross section, are lens-shaped, and where associated with fragmental beds have unconformable relations. This shows that some of the lava flows took the form of streams, relatively narrow, rather than of broad sheets. Such a feature is in accord with the distribution of rock types. Thus along Ptarmigan Ridge for considerable vertical and horizontal range the rock shows only slight variation. The distribution of rock types will be more fully discussed in a later paragraph.

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Of how large a part of the lava flows the crater still remaining was the point of origin is a queston to be answered only after more detailed observation has been made. The best section for the study of the succession of flows and ejectamenta is the amphitheater at the head of the Carbon Glacier. The 4,000 feet of rock in this bold wall would afford an excellent opportunity for this were it not that frequent avalanches preclude the possibility of geologic study except at long range.

MEGASCOPIC CHARACTERS

The volcanic rocks of Rainier are of varying color and texture. Dense black rocks with abundant phenocrysts of glassy feldspars, rough and coarse lavas of different tints of pink, red, and purple, and compact light-gray rocks are some of the types represented upon the slopes of this volcanic cone. In color, the majority of the rocks may be grouped together as light gray to dark gray. The black and red lavas are less common. In texture, the Rainier lavas are, for the most part, compact. Slaggy and scoriaceous phases are common, but probably represent only a small part of the different flows. Near the Guardian Rocks large masses of ropy lava are found which suggest ejected bombs. Agglomeratic and tuffaceous rocks are of quite common occurrence, although less important than the lavas. Vesicular lavas occur at several localities, and fragments of a light-olive pumice, many as large as a foot in diameter, wholly cover some of the long, gentle slopes southeast of Little Tahoma and in Moraine Park.

Contraction parting or jointing is often observed, being especially characteristic of the basaltic types. The platy parting is the more common, but the columnar or prismatic parting is well exhibited at several localities. The black basaltic lava east of Cowlitz Glacier shows the latter structure in a striking manner.

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The blocks resemble pigs of iron in size and shape, and where exposed in a vertical cliff these seem to be piled in various positions.

The rocks on the higher slopes of Mount Rainier are in general very fresh in appearance. An exception may be noted in the case of the rocks at the base of Little Tahoma, where some alteration is evident. The bright coloring of the surfaces of the lava blocks and the general appearance of the face of the cliff may indicate fumarole action at this point. There is also some decomposition along the inner edge of the crater rim, near the steam vents. On the lower slopes, some distance below the snow line, the freshness of the rock is not a noticeable feature, and it is seen that here weathering is of the nature of chemical decomposition as well as of mechanical disintegration.

MICROSCOPIC CHARACTERS

Microscopically these lavas show more uniformity than is apparent megascopically. Rocks which in color and texture appear quite diverse are found to be mineralogical equivalents. The majority of these rocks are andesites, the hypersthene-andesites predominating, as was shown by Hague and Iddings; but over large areas the andesites are decidedly basaltic, and, indeed, many of the lavas are basalts. The megascopic differences are mostly referable to groundmass characters, the color of the rock being dependent upon the color and proportion of glassy base present. Therefore the degree of crystallization of groundmass constituents is of more importance in determining the megascopic appearance than is the mineralogical composition, and the basaltic lavas are for the most part light gray in color, while the more acid hypersthene-andesites are often black or red.

In petrographic character the lavas range from hypersthene-andesite to basalt. This variation is dependent

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upon the ferromagnesian silicates, and four rock types are represented — hypersthene-andesite, pyroxene-andesite, augite-andesite, and basalt — any of which may carry small amounts of hornblende. A rigid separation of these rock types, however, is impossible, since insensible gradations connect the most acid with the most basic. In the same flow hypersthene-andesite may occur in one portion, while in close proximity the lava is an augite-andesite.

These lavas have groundmass textures that vary from almost holo-crystalline to glassy. The felted or hyalopilitic texture is the most common, and plagioclase is the principal groundmass constituent. The feldspars are lath-shaped, often with castellated terminations. In the more basic phases anhedrons of augite and of olivine appear, and magnetite grains are usually present. Flowage is often beautifully expressed by the arrangement of the slender laths of feldspar.

Among the phenocrysts feldspar is the most prominent. It has the usual twinning characteristic of plagioclase and belongs to the andesine-labradorite series, extinction angles proving basic andesine and acid labradorite to be the most common. Zonal structure is characteristic, being noticeable even without the use of polarized light. Zonal arrangement of glass inclusions testifies to the vicissitudes of crystallization, and often the core of a feldspar phenocryst is seen to have suffered corrosion by the magma and subsequently to have been repaired with a zone of feldspar more acid in composition.

Of the darker phenocrysts, the pyroxenes are more abundant than the olivine or hornblende. Hypersthene and augite occur alone or together, and are readily distinguished by their different crystallographic habits as well as by their optical properties. The hypersthene is usually more perfectly idiomorphic and occurs in long prisms, with the pinacoidal planes best developed, while the augite is in stout prisms,

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usually twinned. Both are light colored, and the pleochroism of the hypersthene is sometimes quite faint. According to the relative importance of these two pyroxenes, the lavas belong to different types, hypersthene-andesite, pyroxene-andesite, or augite-andesite.

Olivine occurs in certain of the Rainier lavas, in stout prisms somewhat rounded and often with reddened borders. The usual association with apatite and magnetite crystals is noted. The olivine varies much in relative abundance, so as to be considered now an accessory and now an essential constituent, and in the latter case the rock is a basalt.

Hornblende is not abundant in any of the rocks studied, although typical hornblende-andesite has been described among the specimens collected by Professor Zittel. Where it occurs it is in brown crystals, which have usually suffered magmatic alteration. In one case, where this alteration is less marked, the idiomorphic hornblende is found to inclose a crystal of labradorite, and thus must have been one of the latest phenocrysts to crystallize. It also surrounds olivine in this same rock,[1] which is a hypersthene-andesite, the hornblende and olivine being only accessory.

The different textures of these lavas are doubtless expressive primarily of diversity in the physical conditions of consolidation, but also in part of variations in chemical composition. The variations in mineralogical composition are likewise referable to these two factors, but here the latter is the more important. The hypersthene-augite olivine variation, already referred to, doubtless well expresses the chemical composition of the magma, and deserves to be taken as the chief criterion in the classification of the lavas. As was noted by Hague and Iddings, the hypersthene and olivine play a like rôle, the former occurring when the silica percentage is somewhat higher than in basalt.

[1] Observed by Iddings: Twelfth Ann. Rept. U. S. Geol. Survey, p. 612.

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It is exceptional to find the two in the same specimen, the one being absent whenever the other is present. The following analysis[1] of the typical hypersthene-andesite from Crater Peak shows the lava to be a comparatively acid andesite:

ANALYSIS OF HYPERSTHENE-ANDESITE FROM CRATER PEAK, MOUNT RAINIER

	PER CENT.
SiO_2	61.62
Al_2O_3	16.86
FeO	6.61
CaO	6.57
MgO	2.17
Na_2O	3.93
K_2O	1.66
	99.42

An analysis[2] of one of the light-gray, olivine-bearing rocks on the northern slope of the mountain gives a silica percentage of 54.86, and is doubtless representative of the more basic of the Rainier lavas.

The sporadic occurrence of hornblende in these andesites is principally the result of physical conditions rather than of chemical composition. The magmatic alteration of the phenocrysts of hornblende affords evidence of this variation in consolidation conditions, a diminution of pressure with continuance of slow cooling giving rise to the magmatic alteration of the hornblende. That this change took place during the later stages of consolidation is shown by the relative age of the hornblende, noted above, and also by the fact that in one case a phenocryst of augite, where it abuts against the hornblende, has protected the latter from this alteration. The alteration is in part pseudo-

[1] Hague and Iddings: Twelfth Ann. Rept. U. S. Geol. Survey, p. 225.
[2] Oebbeke, *op. cit.*, p. 226.

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morphic, the hornblende retaining its characteristic outlines, but often there has been resorption. In one andesite the abundance of these remnants of hornblende and also of augite anhedrons in the groundmass may justify the conclusion that this augite andesite is of derivative origin, of the class described by Washington.[1] It may be noted also that hypersthene shows a tendency to magmatic alteration, although only rarely.

In a basal flow in Moraine Park, the slaggy and compact phases show differences in phenocrysts as well as in ground mass. The glassy rock has hypersthene as the predominant phenocryst, while feldspar is the more important in the compact and more crystalline andesite.

The distribution of the rock types described above is of interest. On the northern slope of the mountain, between Willis and Carbon glaciers, the characteristic lava is a gray andesite, smooth to rough in texture, and showing platy and columnar parting. Hypersthene is not the prevailing pyroxene, and olivine is usually present, often in such abundance as to make the rock a basalt.

In Moraine Park gray andesites also predominate, with both pyroxenes as phenocrysts, but here hypersthene is the more important. On the eastern slope on the Wedge, between Winthrop and Emmons glaciers, the lavas are pyroxene-andesites and vary much in megascopic appearance, although little in microscopic characters. These rocks are quite distinct from any seen to the north. The nunatak in Emmons Glacier is composed of hypersthene-andesite, but on Little Tahoma the lava shows more variety. Both augite-andesite and hypersthene-andesite occur, while at the southern end of this interglacial rock mass, just east of Cowlitz Glacier, the cliffs are composed of the prismatic black basalt. On Crater Peak, and

[1] Jour. Geol., Vol. IV, 1896, p. 276.

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below on Gibraltar, hypersthene andesite occurs with considerable variation of color and texture. On the spurs west of Nisqually Glacier the andesites contain both pyroxenes, the augite being somewhat the more important.

The distribution of the volcanic rocks, as determined in the study of reconnaissance collections, indicates that the cone has been built up by eruptions of lava and of fragmental material. The successive lava streams were doubtless of considerable thickness, but were limited in lateral extent. The beds of fragmental material are of the nature of flow breccias and of coarse agglomerates on the higher slopes, while tuffs occur at a greater distance from the center of eruption. This composite cone appears to be remarkably free from radial dikes, which may indicate that the volcanic energy was expended chiefly at the crater. The variation in rock types on different sides of the volcanic cone may be evidence of changes in position of the center of eruption. The destruction of an earlier crater and the eccentric position of a later would give rise to such a radial distribution of lavas as has been described above.

GRANITE

OCCURRENCE

The presence of an acid holocrystalline rock on the slopes of Mount Rainier was first reported by Lieutenant Kautz in 1857, from whose accounts Dr. George Gibbs was led to announce the occurrence of granite as a dike in recent lavas.[1] Emmons in 1870 observed a cliff of "beautiful white syenitic granite" rising above the foot of Nisqually Glacier and correctly interpreted the geologic relations. In 1895, on a reconnaissance trip, the writer identified granite among the bowlders composing the lateral moraines of Carbon

[1] Emmons, Bull. Am. Geog. Soc., 1877, No. 4, p. 45.

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Glacier, as well as on the surface of the glacier itself, and in the following season bowlders of granite were found to be plentiful in the river bed at the foot of this glacier. This anomaly of granite bowlders coming from a volcanic peak was also noted in the canyon of the Nisqually by Emmons.

In the somewhat more careful study of the Mount Rainier rocks, search was made and the granite was found in place at several points on the northeastern slope. A biotite-hornblende-granite was observed on Carbon River at the mouth of Canada Creek, about 12 miles from the summit of Mount Rainier, and at Chenuis Falls, 2 miles up the river, a finer grained holocrystalline rock occurs, apparently an aplitic phase of the granite. In the lower portion of Carbon Glacier, near its eastern edge, a nunatak of granite can be seen, while the same rock occurs farther to the east, beyond the older of the lateral moraines. Higher on the slopes of Rainier a more marked ridge of granite was traced. A knob rises above the eastern moraine of Carbon Glacier at an altitude of between 7,000 and 8,000 feet, and the more prominent features to the east in Moraine Park also owe their survival to the greater erosion-resisting power of the granite.

PETROGRAPHIC DESCRIPTION

These granites have few features worthy of special mention. Hornblende and biotite are the ferromagnesian constituents and vary much in relative importance. The variations from hornblende-granite to biotite-granite occur in the same knob or ridge, and considering all occurrences the two varieties seem to be of equal development. There is also some variation in the amount of quartz present, and in the relative importance of the orthoclase and plagioclase. All of these characters are also found in the granites of the Northern Cascades.

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RELATION TO THE VOLCANIC ROCKS

Along the side of the knob overlooking Carbon Glacier the granite as seen from a distance appears to be intrusive. Blocks of andesite cover the slope, deposited there by the glacier at a time when it possessed greater lateral extent, and the granite talus from above crosses this same slope in a narrow band. The relations prove less deceptive on close examination, and the granite is seen to constitute an older ridge. Farther along this ridge, at the cliffs on the north-eastern edge of Moraine Park, the granitic rock is found overlain by the lava. The actual contact of the two rocks is concealed by soil filling the crevice left by disintegration along the contact plane. The granite, however, exhibits no intrusive characters, while the overlying andesite becomes scoriaceous in its lower portion, although compact immediately above. This contact is on the southern side of the granite ridge, the crest of which is approximately east-west. This position of the lava contact considerably below the highest occurrence of the granite indicates that the topographic features of this old granite ridge were even more marked at the time of the eruption of the lavas and the building of the volcanic cone. Above this ridge of granite on the one side tower the cliffs of bedded volcanics which compose the Sluiskin Mountains, and on the other is the andesite ridge bounding the canyon of Winthrop Glacier. Thus Mount Rainier, although a volcanic peak, rests upon an elevated platform of granite which is exposed by erosion at a few points on the slopes of the mountain.

SUMMARY

The volcanic rocks of Mount Rainier include both lavas and pyroclastics. The breccias, agglomerates, and tuffs, although of striking appearance, are, per-

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haps, less important elements in the construction of the composite cone.

The lavas vary much in color and texture, but these megascopic differences are referable rather to the degree of crystallization of the magma than to its chemical character. The variation in the chemical composition of the lavas expresses itself in mineralogical differences, and thus four rock types are distinguished — hypersthene-andesite, pyroxene-andesite, augite-andesite, and basalt. The distribution of these types indicates a radial arrangement of lava streams, and hypersthene-andesite is the more abundant variety of lava.

Granite is exposed on the slopes of Rainier where erosion has cut away the overlying lava, and it is plain that the volcanic cone rests upon an elevated platform of older rock, approximately 8,000 feet above sea level.

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XVI. THE FLORA OF MOUNT RAINIER

By PROFESSOR CHARLES V. PIPER

CHARLES VANCOUVER PIPER was born on Vancouver Island, at Victoria, British Columbia, on June 16, 1867. He graduated from the University of Washington in 1885 and since then has received degrees and honors from other institutions and learned societies. He was professor of botany and zoölogy at the Washington Agricultural College (now State College of Washington) from 1892 to 1903. He has been agrostologist in charge of forage crop investigations for the Bureau of Plant Industry, United States Department of Agriculture, since 1903. He has discovered many new forms of plant life and has published many monographs and books in the field of botany. This account of the flora of Mount Rainier was first published in The Mazama (Portland, Oregon) in two articles, one in Volume II, Number 2 (April, 1901), and the other in Volume II, Number 4 (December, 1905). They are reproduced with the consent of the editor of The Mazama, and Professor Piper has revised and amplified them for this purpose.

Up to an elevation of 4,000 feet or more the flanks of Mount Rainier are clothed in a continuous belt of somber forest, broken only where glaciers and their nascent streams have hewn pathways, or where, alas, fire has left desolate slopes marked here and there by the whitened, weather-worn shaft of some old tree, a dreary monument to its destroyed fellows. This forest is composed in its lower reaches largely of Douglas spruce. Scattered through it in smaller quantities one finds Lovely fir, Western white pine, Western hemlock, a few Engelmann spruces, and on the stream banks cedar and yew, and now and then a little cottonwood.

At about the 3,500-foot level the character of the forest changes. The Western hemlock gives way to

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the larger-coned Black hemlock; the Douglas spruce and Lovely fir are replaced by the Noble fir; and the ragged-barked Alaska cedar greets the eye. Another thousand feet and the Subalpine fir replaces its two near relatives. From this point upward, the forest, now composed only of Black hemlock, Alaska cedar and Subalpine fir, to which in some places the White-bark pine must be added, is confined largely to the crests of ridges and straggles up the mountain in irregular broken lines. Between these timbered ridges extensive grassy slopes appear, veritable flower gardens when in their glory.

At 6,500 feet elevation the timber ceases to be. Scraggly prostrate firs and hemlocks, sprawling as it were on the earth for shelter, mark sharply the limit of their endurance. Here, too, the continuous carpet of grass and flowers ceases — and a soil of volcanic sand or powdered pumice supports a very different vegetation. At 10,000 feet the toughest mountaineer of all the flowering plants, *Smelowskia ovalis*, still appears. Far above this, however, even to the crater's rim, lichens trace their hieroglyphics on the rocks; and on the steam-warmed rocks of the crater two mosses find lodgment, *Hypnum elegans* Hooker ?, and *Philonotis fontana* Bridel, the latter even in fruit.

Few plants grow in the dense shades of the lower forests, and these are mainly ericaceous. Most plentiful are *Vaccinium ovalifolium*, *V. macrophyllum*, *Gaultheria ovatifolia*, *Menziesia ferruginea*, *Pachystima myrsinites*, *Cornus canadensis* and *Clintonia uniflora*. Here, too, occur several weird-looking whitish or reddish saprophytes, *Monotropa hypopitys*, *Pterospora andromedea*, and *Corallorhiza mertensiana*.

On the drier portions of the grassy slopes *Lupinus subalpinus*, *Castilleja oreopola*, *Potentilla flabellifolia*, *Pulsatilla occidentalis*, *Erigeron salsuginosus*, *Polygonum bistortoides*, *Phyllodoce empetriformis*, *Cassiope mertensiana* and *Vaccinium deliciosum* are the most

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attractive plants. Where the ground is springy *Veratrum viride* occurs in great clumps and *Dodecatheon jeffreyi*, *Caltha leptosepala* and *Ranunculus suksdorfii* are plentiful.

In the shelter of the Alpine trees *Rhododendron albiflorum*, *Ribes howellii* and *Arnica latifolia* flourish. Along the rills *Gentiana calycosa*, *Arnica chamissonis* and *Mimulus lewisii* form banks of color. On the cliffs *Chelone nemorosa*, *Spiraea densiflora*, *Polemonium humile* and *Castilleja rupicola* are perhaps most conspicuous.

Above the limit of trees, in what have been called "pumice fields," a characteristic series of plants appears. This belt ranges in altitude from 6,500 to 10,000 feet. It is best developed on the east side of the mountain, where the avalanches from Little Tahoma have covered great areas with more or less finely divided basalt. Conspicuous plants of this region are *Lupinus lyallii*, *Spraguea multiceps*, *Polemonium elegans*, *Hulsea nana*, *Erigeron aureus*, *Oreostemma alpigena*, *Polygonum newberryi*, *Poa suksdorfii*, *Draba aureola* and *Smelowskia ovalis*. The last three ascend to above Camp Muir, altitude 10,000 feet.

The first botanist to visit Mount Rainier was Dr. William F. Tolmie, surgeon of the Hudson's Bay Company, who reached the mountain in 1833. He made considerable collections, which were sent to Sir William Hooker. Among Tolmie's plants were several not previously known.

The writer collected on the mountain in 1888 and again in 1889 and 1895. Since then the following botanists have made collections on Mount Rainier: Rev. E. C. Smith, in 1889 and 1890; Dr. E. L. Greene, in 1889; Mr. J. B. Flett in 1895, 1896 and since; Mr. M. W. Gorman in 1897; and Mr. O. D. Allen from 1895 to about 1905.

Most of the work done thus far has been in Paradise Park and its immediate vicinity. Next to this, the

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flora of Spray Park is best known. The east slopes of the peak have been partially explored, but to the knowledge of the writer no botanist has ever yet collected on the west slopes.

The list of plants here given numbers 315 species. In preparing it, Longmire Springs, altitude 2,850 feet, has been selected as the lowermost limit on the south side of the mountain, and Crater Lake, altitude about 3,500 feet, as the limit on the north side. It is quite certain that a considerable number of lowland plants will have to be added to the list here given, and it is possible that a few have been included that will have to be dropped, as the exact place of collection of some species is not clearly indicated on the labels of the specimens. Unless otherwise stated, the notes are based on the writer's observations and specimens, and refer mainly to the Paradise Park region.

There yet remains much to be done in the study of the Mount Rainier flora. A particularly interesting phase of it lies in the matter of altitudinal distribution of the various species.

No attempt is here made to list the plants lower than the ferns. The writer has made considerable collections of the fungi, liverworts and mosses; and Mr. O. D. Allen has also collected the mosses. These plants should receive a larger amount of attention from botanists who visit the mountain in the future.

The following plants were first described from specimens obtained on Mount Rainier:

Petasites nivalis Greene.
Luina piperi Robinson.
Prenanthes stricta Greene.
Oreostemma alpigena (Torrey & Gray) Greene.
Aster amplifolius Greene.
Arnica aspera Greene.
Castilleja rupicola Piper.
Mimulus caespitosus Greene.
Veronica allenii Greenman.
Pedicularis ornithorhyncha Bentham.

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Pedicularis contorta Bentham.
Pentstemon tolmiei Hooker.
Pentstemon newberryi rupicola Piper.
Gentiana calycosa Grisebach.
Gentiana calycosa stricta Grisebach.
Hydrophyllum congestum Wiegand.
Polemonium elegans Greene.
Polemonium bicolor Greenman.
Dodecatheon crenatum Greene.
Vaccinium deliciosum Piper.
Ligusticum purpureum Coulter & Rose.
Hesperogenia stricklandi Coulter & Rose.
Lupinus volcanicus Greene.
Stellaria washingtoniana Robinson.
Potentilla flabellifolia Hooker.
Luzula arcuata major Hooker.
Sitanion rigidum J. G. Smith.
Sitanion rubescens Piper.
Poa saxatilis Scribner & Williams.

The type specimens of *Saxifraga tolmiei* were collected by Tolmie on the "N. W. Coast." It is altogether probable that he got them on Mount Rainier, where the plant is so abundant.

LIST OF SPECIES

COMPOSITAE. (Aster Family.)

Scorzonella borealis (Bongard) Greene.
A plant much resembling a dandelion, occurring on the north side of the mountain.

Troximon alpestre Gray.
A plant much resembling the dandelion, frequent on the grassy slopes at 5,500 feet altitude.

Troximon aurantiacum Hooker.
This species has entire mostly basal leaves, and bears a single head of orange or purple flowers. Common at 5,000 to 6,000 feet.

Troximon glaucum asperum (Rydberg) Piper.
(*Agoseris leontodon asperum* Rydberg.)
A species with large lemon-yellow flowers and hoary pubescent leaves. It occurs in the pumice and lava at 7,500 feet altitude and is quite abundant near the base of Little Tahoma.

Hieracium albiflorum Hooker.
A tall plant with hairy entire leaves and a rather ample corymb

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of white flowers. Essentially a lowland plant, but occurring up to 5,500 feet altitude, especially in burnt ground.

Hieracium gracile Hooker.

A small hawkweed with yellow flowers in black hairy involucres. A common plant at 5,500 to 6,500 feet altitude.

Cirsium edule Nuttall.

Plentiful on the ridges of Moraine Park at the limit of trees. Also reported by Gorman as occurring in open woods near the timber line in Cowlitz canyon. This thistle is abundant at the sea level, and the roots were formerly a favorite food of the Indians.

Saussurea americana D. C. Eaton.

A peculiar plant with leafy stems, two to four feet high, bearing a dense cluster of elongate rayless heads of purple flowers. Found only on the high ridge north of the foot of Cowlitz Glacier.

Senecio ochraceus Piper.

Goat Mountains, Allen, No. 230.

Senecio triangularis Hooker.

A tall species with triangular coarsely dentate leaves and numerous rather small heads of yellow flowers. Abundant in the marsh at Longmire Springs and in wet places on the mountain slopes up to 6,000 feet altitude.

Senecio ductoris Piper.

A low species with thickish crenate leaves and deep yellow heads. Found only on the moraine on the south side of Cowlitz Glacier.

Senecio flettii Wiegand.

Found near Cowlitz Chimneys by Miss Winona Bailey, in 1915; previously known only from the Olympic Mountains.

Arnica latifolia Bongard.

A smooth cordate leaved plant with one to five heads, resembling small sunflowers. Not uncommon up to 6,000 feet altitude, especially in the shelter of timber.

Arnica mollis Hooker.

Similar to the preceding, but the leaves oblong, nearly entire, and viscid glandular. Abundant along the rivulets, 4,000 to 6,000 feet altitude.

Arnica aspera Greene.

Described from specimens collected in Spray Park. It is very similar to *A. mollis* Hooker, but the pubescence is coarser.

Arnica eradiata (Gray) Heller.

Closely related to the preceding but easily recognized by its rayless heads. It occurs on the steep slopes above Sluiskin Falls.

Luina hypoleuca Bentham.

A beautiful suffruticose plant, six to twelve inches high, with

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entire oval leaves shining green above and white tomentose beneath. It was originally discovered by Dr. Lyall, of the International Boundary Survey, in the Cascade Mountains at the 49th parallel. It is not uncommon about Mount Rainier, occuring on perpendicular cliffs along the Cowlitz Glacier; in similar places on the banks of the Nisqually at Longmire Springs; and on the gravel bars of the same river. The flowers are cream-colored.

Rainiera stricta Greene.
(*Prenanthes stricta* Greene.)
(*Luina piperi* Robinson.)
(*Luina stricta* Robinson.)

A tall plant with large oblong entire leaves and a long raceme of yellowish, rayless heads. Professor Greene makes it the type of a new genus *Rainiera*, while Dr. Robinson refers it to *Luina*. The plant has been collected in Spray Park by Professor Greene; on the Goat Mountains, Allen; near Mount Adams, Henderson; head of Naches River, Vasey; and on the high ridge northeast of the foot of Cowlitz Glacier by the writer. The statement that the plant has milky juice is an error.

Petasites speciosa (Nuttall) Piper.
(*Nardosmia speciosa* Nuttall.)

Abundant along streams up to 3,000 feet altitude. Easily recognized by its large palmate leaves, which frequently measure a foot or more in diameter. The flowers appear very early in spring with the leaves and have an odor suggesting violets. This species is clearly distinct from the Eastern *P. palmata* (Aiton) Gray and was long ago well characterized by Nuttall.

Petasites frigida (Linnaeus) Fries.
(*Petasites nivalis* Greene).

Common along rivulets 4,000 to 5,000 feet altitude. Resembling the preceding species, but much smaller and with quite different leaves.

Achillea lanulosa Nuttall.

An Alpine form of the common Western yarrow. Not rare in the decayed lava at 6,000 to 7,000 feet altitude.

Hulsea nana Gray.

A sticky plant with pinnatifid leaves and large yellow heads. Plentiful on the east side of the mountain near the base of Little Tahoma in the pumice fields. This seems to be the northernmost limit of the plant.

Anaphalis margaritacea occidentalis Greene.

The well-known "Everlasting Flower," which occurs in dry or burnt woods up to 4,000 feet altitude.

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Antennaria media Greene.

A small depressed cudweed, only an inch or two high. Common at 6,000 feet altitude.

Antennaria lanata (Hooker) Greene.

Like the preceding but larger and more hairy. Grassy slopes at 6,000 feet. Common.

Antennaria racemosa Hooker.

Collected by Allen in the "upper valley of the Nisqually." A much larger and greener plant than the preceding species.

Erigeron salsuginosus (Richardson) Gray.

The common pink aster or "daisy" of the grassy slopes. One of the most conspicuous plants at 4,000 to 6,000 feet altitude, but even ascending to 7,000 feet in a much dwarfed form.

Erigeron acris debilis Gray.

An insignificant white-flowered species, rare at about 7,500 feet altitude.

Erigeron compositus trifidus (Hooker) Gray.

A small pinkish aster, with the leaves cut into linear lobes. Growing in decayed lava at 7,500 feet altitude.

Erigeron speciosus De Candolle.

A handsome species with entire ciliate leaves and rather numerous heads, with deep violet rays. Collected by Allen in the Goat Mountains, No. 222.

Erigeron aureus Greene.

(*Aplopappus brandegei* Gray.)

A beautiful little aster with bright golden rays, the solitary heads on scapes two or three inches tall. Abundant in the pumice, 7,500–8,000 feet altitude.

Aster ledophyllus Gray.

A tall species with leafy stems, and numerous middle-sized heads with pink-purple rays. The leaves are entire, pubescent on the under side. Not uncommon on the grassy slopes at 5,000 feet altitude.

Aster foliaceus frondeus Gray.

(*Aster amplifolius* Greene.)

A species with broad half-clasping leaves and deep-violet-colored rays. Professor Greene's type came from Mount Rainier, but his species seems not to differ from the plant earlier described by Dr. Gray.

Oreostemma alpigena (Torrey & Gray) Greene.

(*Aster pulchellus* D. C. Eaton.)

A low plant with narrow tufted leaves, the scapes bearing one or rarely two large heads. The rays are deep violet. The plant

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is common in the pumice fields at 7,000–8,000 feet altitude, but, strange to say, also occurs on the borders of small lakes at the foot of Pinnacle Peak at 4,500 feet elevation. In exposed places at high altitudes the leaves are often curiously twisted. It was originally described from the specimen collected on Mount Rainier by Tolmie.

Solidago algida Piper.

A small goldenrod, two to twelve inches tall, occurring ordinarily on the faces of perpendicular cliffs at 5,000 to 6,000 feet elevation.

Artemisia borealis wormskioldii Besser.

A silky canescent wormwood about one foot high, its leaves pinnate; found on the north side of the mountain by Flett.

Artemisia richardsoniana Besser.

In the Synoptical Flora, Vol. II, p. 371, this species is stated to have been collected on Mount Rainier by Tolmie. On the sheet in the Gray Herbarium Dr. Gray has indicated that this is an error, the specimens having really been collected in the Rocky Mountains by Burke.

CAMPANULACEAE. (Bellflower Family.)

Campanula rotundifolia Linnaeus.

This charming and familiar blue bell is abundant on the cliffs near the foot of Cowlitz Glacier.

VALERIANACEAE. (Valerian Family.)

Valeriana sitchensis Bongard.

An abundant plant at 4,000 to 6,000 feet altitude. The leaves are pinnately compound, the rather large leaflets repandly dentate. The flowers are whitish, usually pink tinged. Like other species, this valerian has a decidedly unpleasant odor, that is difficult to compare with any other. To the writer the odor is always associated with mountain meadows, doubtless because it so frequently predominates in such places.

RUBIACEAE. (Madder Family.)

Galium triflorum Michaux.

A very common species of bedstraw which ascends on the lower slopes of the mountain.

Galium oreganum Britton.

Goat Mountains, Allen, No. 296.

SCROPHULARIACEAE. (Figwort Family.)

Chelone nemorosa Douglas.

A handsome plant with opposite serrate leaves and corymbs of purple-red flowers somewhat like those of the foxglove. Dry cliffs and slopes at 5,000 feet altitude. Also reported by Gorman as occurring at Longmire Springs.

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Pentstemon confertus Douglas.

A species with entire leaves and dense clusters of small pale yellow flowers. In its typical form the species is one to two feet tall, but on Mount Rainier, where it occurs at from 7,000 to 8,000 feet elevation, it is reduced to two to four inches high, but otherwise not differing from the type.

Pentstemon procerus Douglas.

Like the above, but blue flowered. It occurs at 8,000 feet and on Rainier is scarcely two inches tall, while at lower altitudes it is frequently as many feet high. This dwarf Alpine form has been described by Professor Greene as a new species under the name of *Pentstemon pulchellus*. It is an interesting fact that Tolmie long ago collected on Mount Rainier a dwarf species which Hooker named *Pentstemon tolmiei*. But alas, the specimens are in fruit, and it is past finding out now whether his plant was the yellow-flowered or the blue-flowered form. Most likely, however, it was the latter, as that is far more frequent than the yellow-flowered form.

Pentstemon diffusus Douglas.

A handsome species with serrate leaves and blue-purple flowers. Mount Rainier, Piper 2068. Goat Mountains, Allen 129.

Pentstemon ovatus Douglas.

Much like the preceding plant, differing essentially in the anthers. Collected by Allen "mountains near the upper valley of the Nisqually," and by the writer on the slopes of Mount Rainier.

Pentstemon menziesii Hooker.

A dwarf prostrate plant with thickish evergreen toothed leaves and dull purple flowers, abundant on the rocks at 8,000 feet elevation. A variety with the leaves entire instead of denticulate, *P. davidsonii* Greene, also occurs on the mountain.

Pentstemon rupicola (Piper) Howell.

Much like the preceding, but with glaucous leaves and rose-colored larger flowers. The writer found it originally on the perpendicular cliffs, at the limit of trees above "Camp of the Clouds."

Collinsia tenella (Pursh) Piper.

Collected by Flett on an old moraine along the Carbon Glacier.

Mimulus lewisii Pursh.

Abundant along rills, 4,000 to 5,000 feet altitude. Easily known by its opposite dentate leaves, viscid pubescence and rose-purple corollas. The original specimens were collected in Idaho by the Lewis and Clark expedition.

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Mimulus breweri (Greene) Rydberg.
(*Eunanus breweri* Greene.)
A minute species with pale purple flowers, abundant on dry cliffs near "Camp of the Clouds."

Mimulus alpinus (Gray) Piper.
(*M. luteus alpinus* Gray.)
(*M. scouleri caespitosus* Greene.)
A dwarf plant with matted stolons, the bright yellow flowers painting the cliffs wherever there is dripping water. The Mount Rainier plants match closely the original types collected by Dr. Parry in Wyoming, so that Professor Greene's name is clearly a synonym of the earlier one of Gray.

Veronica alpina Linnaeus.
A small plant two or three inches high, with several pairs of small, ovate, pubescent leaves, and a terminal raceme of small blue flowers. Common at 4,500 to 5,500 feet altitude.

Veronica cusickii Gray.
A very similar plant to the above, but with larger blue flowers and smooth leaves. Abundant just above "Camp of the Clouds."

Veronica allenii Greenman.
Much like the preceding species, but with smaller white flowers. A new species discovered by Allen "near Paradise River at 5,400 feet elevation."

Castilleja miniata Douglas.
This vivid scarlet "Painted Cup" or "Indian Pink" is easily known by its entire leaves. Not infrequent at 5,000 to 6,000 feet; also occurring at lower altitudes down to sea-level.

Castilleja angustifolia hispida (Bentham) Fernald.
Very similar to the last, but the flower spikes shorter and the leaves cut-lobed. Bear Prairie, Allen.

Castilleja rupicola Piper.
Like the last, but smaller, the leaves usually purplish and deeply cut, the flowers intensely scarlet and with very long beaks. On the cliffs on both sides of Sluiskin Falls, whence the original specimens were obtained.

Castilleja oreopola Greenman.
The common species of the grassy slopes, the flowers reddish-purple or occasionally white.

Pedicularis bracteosa Bentham.
A tall "lousewort," with fern-like leaves and a long terminal spike of greenish-white flowers. Frequent in wet places up to 5,500 feet altitude.

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Pedicularis contorta Douglas.
A yellow-flowered species not rare at 7,000 feet elevation along the Nisqually Glacier. First found by Tolmie on Mount Rainier.

Pedicularis surrecta Bentham.
The reddish flowers with long, coiled beaks easily distinguish this plant. Common in wet meadows at 4,000 feet altitude.

Pedicularis ornithorhyncha Bentham.
Much like the preceding but with beakless flowers. Originally described from Mount Rainier specimens collected by Tolmie in 1833, and not again seen until the writer collected them in the same place in 1888. The plant has since been found at two or three places north of Mount Rainier, but all in Washington.

Pedicularis racemosa Douglas.
The commonest species, easily known by its half prostrate habit, lanceolate leaves, and short clusters of white or pinkish twisted flowers. Ranges from 3,000 to 5,000 feet elevation.

PINGUICULACEAE. (Butterwort Family.)

Pinguicula vulgaris Linnaeus.
The butterwort, with its greasy entire leaves in a rosette and solitary violet flowers is not rare on moist cliffs.

LABIATAE. (Mint Family.)

Madronelia discolor Greene.
A very sweet-smelling plant, the only mint as yet found on the mountain. Occurs on the talus of the high cliffs on the north side of Cowlitz Glacier.

BORAGINACEAE. (Borage Family.)

Mertensia laevigata Piper.
A handsome branched herb, two feet high or more. The large entire leaves and the cluster of small blue tubular flowers make it readily recognizable. Frequent at 4,000 to 5,000 feet altitude.

Cryptantha muriculata (A. De Candolle) Greene.
Goat Mountains, Flett; a small common lowland plant with white flowers.

HYDROPHYLLACEAE. (Waterleaf Family.)

Hydrophyllum albifrons Heller.
(*Hydrophyllum congestum* Wiegand.)
On the meadows near Van Trump Glacier.

Romanzoffia sitchensis Bongard.
A handsome little plant with orbicular coarsely dentate leaves and a loose cluster of small white flowers. In habit much like some saxifrages. Rare on wet cliffs near Sluiskin Falls.

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Phacelia nemoralis Greene.
This plant occurs on rock talus along the north side of Cowlitz Glacier.

Phacelia sericea Gray.
A handsome species with silvery leaves and dense clusters of purple flowers. Collected somewhere on the mountain by Rev. E. C. Smith in 1890.

POLEMONIACEAE. (Phlox Family.)

Phlox diffusa Bentham.
A prostrate plant with acerose leaves, when in bloom forming dense masses of pale blue. Common at 5,500 to 6,500 feet altitude, in rocky soil.

Gilia gracilis (Douglas) Hooker.
Growing on an old moraine along Carbon Glacier, Flett.

Gilia nuttallii Gray.
A white-flowered species found by Rev. E. C. Smith in 1890 somewhere on the southwest slopes of the mountain.

Collomia debilis (Watson) Greene.
Not rare in talus at the base of basalt cliffs on the east side of the mountain at 7,000 feet altitude.

Collomia heterophylla Hooker.
Found by Mr. Gorman on the gravelly banks of the Nisqually at Longmire Springs; also by Flett; a common lowland plant.

Polemonium humile Roemer & Schultes.
A handsome plant with pinnate leaves and corymbs of pale blue flowers. Common on the rocks at 5,000 to 6,000 feet altitude.

Polemonium elegans Greene.
(*P. bicolor* Greenman.)
Similar to the preceding, but smaller and very glandular, the blue flowers having a large yellow center. Rather rare in pumice at 7,500 feet elevation.

Polemonium viscosum pilosum Greenman.
Very much like the preceding plant. Discovered by Allen on the Goat Mountains, No. 261.

GENTIANACEAE. (Gentian Family.)

Gentiana calycosa Grisebach.
An elegant plant with deep blue bell-shaped flowers. Abundant along the rills at 5,000 feet. The species was described from Mount Rainier specimens collected by Tolmie in 1833. Grisebach also described a variety *stricta*, based on very trivial characters.

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PRIMULACEAE. (Primrose Family.)

Dodecatheon jeffreyi Van Houtte.
(*D. crenatum* Greene.)
(*D. viviparum* Greene.)
Plentiful in wet places at 4,500 to 5,500 feet elevation. Professor Greene's types came from Spray Park.

Douglasia laevigata Gray.
A handsome little plant forming broad mats and bearing blood-red flowers in corymbs. Goat Mountains, Allen.

Trientalis latifolia Hooker.
Gorman reports this plant as occurring in coniferous woods between Longmire Springs and Paradise Park.

PYROLACEAE. (Indian Pipe Family.)

Chimaphila umbellata (Linnaeus) Nuttall.
Reported by Gorman "on the trail above Longmire Springs, in coniferous woods."

Chimaphila menziesii (R. Brown) Sprengel.
In deep coniferous woods, 2,000 to 4,000 feet elevation.

Pyrola secunda Linnaeus.
Growing with the preceding.

Pyrola bracteata Hooker.
Reported by Gorman "in coniferous woods along the Nisqually River at 2,850 feet."

Moneses uniflora (Linnaeus) Gray.
In woods near the base of the mountain.

Monotropa hypopitys Linnaeus.
Common in the dense shade of conifers along the trail above Longmire's.

Pterospora andromedea Nuttall.
This peculiar plant occurs along the Nisqually trail at about 3,000 feet altitude.

Allotropa virgata Torrey & Gray.
This queer plant is abundant in coniferous woods on the north side of the mountain, but it is doubtful whether it comes within our limits.

ERICACEAE. (Heath Family.)

Menziesia glabella Gray.
A shrub four to eight feet high, much resembling a huckleberry, but the fruit is dry.

Kalmia polifolia microphylla (Hooker) Piper.
In wet places at 7,000 feet altitude near Nisqually Glacier.

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Phyllodoce empetriformis (Smith) D. Don.
The common red-flowered heather, abundant on dryish slopes at 5,000 to 6,000 feet elevation.

Phyllodoce glanduliflora (Hooker) Coville.
Much like the preceding, but the flowers yellowish-white and glandular. Frequent at 6,500 to 7,500 feet elevation.

Cassiope mertensiana (Bongard) Donn.
A low shrub growing with *Phyllodoce empetriformis*, and having small pendent, bell-shaped white flowers.

Harrimanella stelleriana (Pallas) Coville.
On the moist cliffs overlooking the Nisqually Glacier, at 5,500 feet elevation. This is the southernmost known station for the plant.

Gaultheria shallon Pursh.
The salal-berry is reported by Gorman to occur in coniferous woods between Longmire Springs and Paradise Park.

Gaultheria ovatifolia Gray.
This species resembles a diminutive plant of the preceding, but the berries are red and spicy, and borne singly in the axils of the leaves. Abundant in the coniferous woods at 3,000 to 3,500 feet elevation.

Gaultheria humifusa (Graham) Rydberg.
Much like a small plant of the preceding species, and only an inch or two high. Not rare on the slopes near Sluiskin Falls.

Rhododendron albiflorum Hooker.
(*Cladothamnus campanulatus* Greene).
The white-flowered azalea so common in the shelter of trees at 5,000 to 5,500 feet elevation.

Arctostaphylos uva-ursi Linnaeus.
The kinnikinnik, essentially a lowland plant, covers the rocks at 8,000 feet altitude near Nisqually Glacier.

Arctostaphylos nevadensis Gray.
On the gravel bars of the Nisqually at Longmire Springs.

Vaccinium macrophyllum (Hooker) Piper.
The most valuable of all the native huckleberries. Easily recognized by the nearly black, not glaucous berries, and finely serrate leaves. Plentiful at 3,000 to 4,000 feet altitude.

Vaccinium ovalifolium Smith.
Much like the preceding, but taller, the leaves entire, and the glaucous black berries not nearly so sweet.

Vaccinium myrtillus microphyllum Hooker.
(*V. scoparium* Leiberg.)
A low, broom-like species, with small leaves and red or wine-colored berries. On dry ridges, 4,000 to 5,000 feet altitude.

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Vaccinium deliciosum Piper.
This is the common bilberry of the alpine meadows of the Cascade and Olympic Mountains in Washington, where it is abundant at 4,500 to 5,500 feet altitude. In habit and fruit it resembles *V. caespitosum*, but in floral characters *V. ovalifolium*, to which Dr. Gray rather hesitatingly referred it. From this last it may readily be distinguished by its serrulate leaves and low habit, its relatively longer filaments, which in *V. ovalifolium* are only one half as long as the anthers, and its small-seeded fruit of very different flavor. Very young leaves have the serrulations tipped with small glandular appendages.

UMBELLIFERAE. (Parsley Family.)

Ligusticum purpureum Coulter & Rose.
A tall "wild parsnip," with fern-like leaves and small whitish or purple-tinged flowers. Everywhere on the slopes, 4,000 to 6,000 feet elevation.

Lomatium angustatum Coulter & Rose.
In rock talus near Sluiskin Falls.

Lomatium triternatum Coulter & Rose.
A form of this variable species was found on the Goat Mountains by Allen, No. 257.

Angelica lyallii Watson.
Paradise Park, 5,000 feet elevation. Also common near the foot of Cowlitz Glacier.

Sanicula septentrionalis Greene.
Goat Mountains, Allen, No. 254.

Osmorhiza ambigua (Gray) Coulter & Rose.
Goat Mountains, Allen, No. 256.

Heracleum lanatum Michaux.
Common at 4,000 feet elevation.

Hesperogenia stricklandi Coulter & Rose.
An interesting plant, the type of a new genus, found in Paradise Park by Allen and by Strickland. Also collected on the mountain by Flett. Occurs at 6,500 feet elevation.

HALORAGIDACEAE. (Water Milfoil Family.)

Hippuris vulgaris Linnaeus.
Found by Allen at Longmire Springs.

Hippuris montana Ledebour.
An interesting little species much resembling some mosses. It frequently mats the ground in wet places at 4,500 feet elevation.

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ONAGRACEAE. (Evening Primrose Family.)

Epilobium spicatum Lamarck.

The common "fireweed," reported by Gorman on the "grassy slopes, 5,000 to 6,000 feet altitude."

Epilobium latifolium Linnaeus.

A species with flowers like the preceding, but only four to six inches tall. Found by Rev. E. C. Smith near the Cowlitz Glacier.

Epilobium luteum Pursh.

A yellow-flowered species common along streams, 3,000 to 5,000 feet elevation.

Epilobium alpinum Linnaeus.

(*E. hornemanni* Reichenbach.)

Common at 4,000 to 6,000 feet altitude.

Epilobium anagallidifolium Lamarck.

A minute species found on the Tatoosh Mountains by Allen.

Epilobium clavatum Trelease.

Gravelly slopes at 5,000 feet. Plentiful along the Cowlitz Glacier.

Epilobium fastigiatum (Nuttall) Piper.

A glaucous-leaved small species, on the gravel bars of the Nisqually, and up to 4,500 feet elevation.

Gayophytum ramosissimum Torrey & Gray.

On gravelly slopes near the foot of Cowlitz Glacier.

VIOLACEAE. (Violet Family.)

Viola palustris Linnaeus.

The common swamp violet was found at Narada Falls by Flett.

Viola adunca Smith.

Rare in rock crevices near Sluiskin Falls. Flowers deep violet.

Viola montanensis Rydberg.

Like the preceding, but the leaves puberulent. Near Van Trump Glacier, at 6,000 feet altitude.

Viola glabella Nuttall.

A yellow-flowered species common along streams and in rich woods up to 3,000 feet altitude.

HYPERICACEAE. (St. Johnswort Family.)

Hypericum bryophytum Elmer.

A diminutive plant along rills at 5,000 feet elevation.

ACERACEAE. (Maple Family.)

Acer douglasii Hooker.

The smooth maple is common on the headwaters of the Nisqually.

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CELASTRACEAE. (Staff Tree Family.)

Pachystima myrsinites (Pursh) Rafinesque.

An evergreen shrub two or three feet high, having considerable resemblance to a huckleberry. Common in coniferous woods at 3,000 to 4,000 feet elevation.

EMPETRACEAE. (Crowberry Family.)

Empetrum nigrum Linnaeus.

A prostrate cespitose shrub with yew-like leaves and black berries. Common on the rocks at 7,500 feet altitude.

OXALIDACEAE. (Oxalis Family.)

Oxalis oregana Nuttall.

Common in rich, moist woods up to 3,000 feet altitude.

Oxalis trilliifolia Hooker.

With the preceding, which it resembles. It may be distinguished by its scapes bearing several flowers, instead of only one, and by its narrow pods.

LEGUMINOSAE. (Pea Family.)

Lupinus subalpinus Piper & Robinson.

The common lupine of the grassy slopes, 4,000 to 6,000 feet altitude.

Lupinus volcanicus Greene.

A small species, with hairy pubescence, growing above the limit of the preceding and below that of the following.

Lupinus lyallii Watson.

A lovely little plant with silvery foliage. Abundant in the pumice fields at 7,000 to 8,000 feet altitude.

Lathyrus pauciflorus Fernald.

A wild pea with purple flowers collected by Allen in the Goat Mountains.

Lathyrus nevadensis Watson.

Very like the preceding but with white flowers. Collected by Allen, No. 297, on mountains near the upper valley of the Nisqually.

Oxytropis cusickii Greenman.

Goat Mountains, Allen, No. 245.

ROSACEAE. (Rose Family.)

Spiraea densiflora Nuttall.

A low shrub with dense corymbs of rose-colored flowers. Common in bogs at 4,500 feet, and on rock cliffs up to 6,000 feet elevation.

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Eriogynia pectinata (Pursh) Hooker.

A little shrub only two or three inches tall, forming dense mats. The plant should easily be recognized by its sharply cleft leaves and dense erect racemes of white flowers. Abundant at 5,000 to 6,000 feet elevation. Gorman reports it from near the "Sphinx," 8,500 feet.

Rubus nivalis Douglas.

A trailing vine, with glossy, green, simple leaves. Common in the coniferous forests at 3,000 feet altitude, where it seldom blooms. On exposed rocks and banks one rarely finds its dull red flowers or bright red, raspberry-like, sour fruit.

Rubus pedatus Smith.

A trailing herbaceous plant, with palmately compound leaves and strawberry-like blossoms. The smooth red fruit is sour, and consists of only a few large drupelets. Common in the woods up to 4,000 feet altitude.

Rubus lasiococcus Gray.

Much like the preceding, but with simple leaves and pubescent fruit. Grows with the preceding, and up to 5,000 feet or more.

Potentilla flabellifolia Hooker.

The common cinquefoil of the meadows, with bright yellow buttercup-like flowers. Plentiful at 5,000 feet elevation.

Potentilla dissecta Pursh.

This has been collected by Allen on the Goat Mountains, No. 251.

Potentilla glaucophylla Lehmann.

Near the foot of Gibraltar, at 8,500 feet altitude.

Potentilla villosa Pallas.

A species with silvery strawberry-like leaves and bright yellow flowers. On the cliffs near the foot of Little Tahoma, at 7,500 feet elevation.

Potentilla fruticosa tenuifolia (Willdenow) Lehmann.

This shrubby cinquefoil occurs along White River Glacier.

Sibbaldia procumbens Linnaeus.

Abundant on the ridge near Sluiskin Falls.

Dryas octopetala Linnaeus.

Found in talus between Urania and White Glaciers by Professor Flett. This is the southernmost known station in the Cascade Mountains.

Pyrus occidentalis Watson.

This mountain ash occurs at 4,500 to 5,000 feet altitude, usually forming dense clumps. It is seldom over four feet high. From related species its dull purple glaucous fruit and dull green leaves, serrate only near the apex, easily distinguish it.

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Pyrus sitchensis (Roemer) Piper.
(*Sorbus sitchensis* Roemer.)
This species grows from four to fifteen feet high, and is easily known by its intense scarlet fruit and shining leaflets, which are sharply serrate to the base. The plant of the Cascade Mountains matches exactly with the type from Sitka, and we can detect no differences in the shrub common in the Blue Mountains and in Western Idaho. This shrub has heretofore been known as *Pyrus sambucifolia* Chamisso & Schlechtendahl, but authentic Kamtschatka specimens of this last are clearly different from our plant.

Rosa nutkana Presl.
This common wild rose has been collected by Allen on the Goat Mountains, at 4,500 feet elevation.

SAXIFRAGACEAE. (Saxifrage Family.)

Ribes howellii Greene.
(*Ribes acerifolium* Howell.)
A small currant, two to four feet high, with pendent racemes of flowers and glaucous black fruit. Common in the shelter of trees up to their limit.

Ribes bracteosum Douglas.
A currant with very large leaves and long, erect racemes of greenish flowers; fruit black. It is common along streams at low altitudes, and is locally known as "stink currant." Gorman reports it from Cowlitz Canyon, near the timber line.

Ribes lacustre (Persoon) Poiret.
This very prickly gooseberry is reported by Gorman from the same locality as the preceding.

Leptarrhena amplexifolia (Sternberg) Seringe.
A handsome plant, with a radical tuft of oblong crenate evergreen leaves, and an erect scape of small greenish flowers in a corymb. The pods when mature are usually deeply tinged with purple. Common on the borders of rills at 5,000 feet, and on the wet cliffs near Sluiskin Falls. Also reported by Professor Greene from Spray Park.

Tiarella unifoliata Hooker.
Common in rich woods up to 3,500 feet elevation.

Mitella breweri Watson.
In the shelter of trees, common at 6,000 feet altitude.

Mitella pentandra Hooker.
Much like the preceding and found in similar places.

Mitella trifida Graham.
Found on Mount Rainier and on Goat Mountains by Allen.

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Parnassia fimbriata König.
A plant with radical reniform leaves and one-flowered scapes. The petals are white and fringed. Not rare in moist places near Sluiskin Falls; also at Crater Lake.

Heuchera glabra Willdenow.
On the cliffs near Camp of the Clouds.

Heuchera micrantha Douglas.
Mount Rainier, *Tolmie*, according to Hooker.

Elmera racemosa (Watson) Rydberg.
(*Heuchera racemosa* Watson.)
Rock crevices at the base of Little Tahoma; rare.

Suksdorfia ranunculifolia (Hooker) Engler.
Rock Cliffs near Camp of the Clouds.

Saxifraga bongardi Presl.
Common along rills, 5,000 to 6,000 feet elevation.

Saxifraga bronchialis austromontana (Wiegand) Piper.
Abundant on rock cliffs near Longmire Springs, and frequent up to 6,000 feet altitude.

Saxifraga marshallii Greene.
Rare on the cliffs near Sluiskin Falls. Also collected on the Goat Mountains by Mr. Allen.

Saxifraga odontoloma Piper.
A species with reniform, coarsely dentate leaves. Common along the rivulets, 5,000 to 6,000 feet altitude.

Saxifraga nelsoniana D. Don.
Much like the preceding, but the petals oval instead of orbicular and clawed. Near Camp of the Clouds; rare.

Saxifraga mertensiana Bongard.
Much like *S. odontoloma*, but the leaves doubly dentate, and usually bearing bulblets among the flowers. North side of Cowlitz Glacier; rare.

Saxifraga tolmaei Torrey & Gray.
Abundant at 5,000 to 7,500 feet elevation, blooming as soon as the snow melts. Easily known by its small, thick, entire leaves, and small white flowers, solitary on scapes an inch or two high. Originally found by Tolmie, from whose specimens the species was described.

Saxifraga debilis Engelmann.
Found on Mount Rainier by Mr. Allen. This is the first record of the plant west of Colorado.

Saxifraga caespitosa Linnaeus.
Collected by Flett and by Allen. Leaves 3 to 5-lobed.

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CRASSULACEAE. (Stonecrop Family.)

Sedum divergens Watson.

This species is easily known by its small globular leaves. Common on the cliffs near Sluiskin Falls.

CRUCIFERAE. (Mustard Family.)

Draba aureola Watson.

A viscid yellow-flowered species, rather rare at and near Camp Muir.

Draba lonchocarpa Rydberg.

In pumice sand at 8,500 feet altitude.

Arabis lyallii Watson.

Common along Paradise River, at 5,000 feet altitude, but also occurring in the pumice at 7,500 feet.

Arabis drummondii Gray.

Piper No. 2065, referable to this species, is from Mount Rainier. Collected near the Cowlitz Glacier.

Cardamine kamtschatica (Regel) Schulz.

(*C. umbellata* Greene.)

A small "bitter-cress," not rare along rills at 5,000 feet elevation.

Erysimum asperum (Nuttall) De Candolle.

A yellow-flowered plant much like a wallflower, rare at 6,000 feet altitude. It occurs also in loose rock near Interglacier.

Smelowskia ovalis Jones.

A small, white-flowered, canescent plant, interesting because it ascends Mount Rainier higher than any other flowering plant. Common from 8,000 to 10,000 feet altitude. One specimen was collected quite at the base of "The Sphinx."

FUMARIACEAE. (Bleeding-heart Family.)

Corydalis scouleri Hooker.

Common along streams at low elevations.

BERBERIDACEAE. (Barberry Family.)

Achlys triphylla (Smith) De Candolle.

Reported by Mr. Gorman "on the trail from Longmire Springs to the Park." The sweet-smelling leaves of this plant have suggested the name of "vanilla leaf."

RANUNCULACEAE. (Buttercup Family.)

Thalictrum occidentale Gray.

This meadow-rue is not rare near the foot of Van Trump Glacier.

Anemone drummondii Watson.

Collected by Flett, No. 2171, on the north side of the mountain at 7,000 feet altitude.

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Anemone hudsoniana (De Candolle) Richardson.
Collected on the Goat Mountains by Mr. Allen, No. 250.

Pulsatilla occidentalis (Watson) Freyn.
Common on the dry slopes 5,000 to 6,000 feet elevation. Flowers large, white or bluish, developing a large head of tailed carpels, which has much the appearance of a hussar's cap.

Trautvetteria grandis Nuttall.
A tall plant with large maple-like leaves and loose corymbs of delicate white flowers. Abundant in shady woods up to 4,000 feet elevation. The pallid blossoms, in sharp contrast to the shade they dwell in, has prompted the name of "ghost flower."

Ranunculus suksdorfii Gray.
A bright-flowered buttercup, not rare in moist places at 5,500 feet elevation.

Ranunculus verecundus Robinson.
On rocky ridges at 7,000 feet altitude, Flett.

Caltha leptosepala De Candolle.
(*C. macounii* Greene.)
Wet places, 4,000 to 6,000 feet; plentiful.

Aquilegia formosa Fisher.
The common scarlet and yellow columbine of the lowland, found on the grassy slopes at 5,500 feet elevation.

Delphinium bicolor Nuttall.
A handsome blue and white-flowered larkspur, found in the Goat Mountains by Mr. Allen, No. 146.

Delphinium glaucum Watson.
This larkspur is tall, three to four feet high, with rather many large leaves, and long racemes of pale blue small flowers. Collected by Mr. Allen in the Upper Nisqually Valley, and by the writer near Crater Lake.

CARYOPHYLLACEAE. (Pink Family.)

Silene lyallii Watson.
(*S. macounii* Watson.)
(*S. douglasii viscida* Robinson.)
Distinguished from its near allies by its four-lobed petals. Not rare at 6,000 feet altitude.

Silene suksdorfii Robinson.
A low species, with scapes mostly one-flowered. Rather rare in the loose basalt talus near the base of Little Tahoma.

Silene acaulis Linnaeus.
The "moss campion" of Europe, and common in the Rocky Mountains. Collected by Mr. Flett near the Mowich Glacier.

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Stellaria borealis Bigelow.
A prostrate chickweed, common along the Paradise River, at 5,000 feet elevation.

Stellaria washingtoniana Robinson.
Described from specimens collected by Allen on the slopes of the mountain at the head of Nisqually River in alder woods.

Sagina occidentalis Watson.
A small species of pearlwort, doubtfully referred here, occurs rarely along rivulets in Paradise Park.

Cerastium arvense Linnaeus.
Goat Mountains, Allen, No. 237.

Arenaria capillaris Poiret.
Common on the rocks at 5,000 to 7,000 feet elevation. The form with curved leaves, variety *nardifolia* Regel, is more frequent than the type.

Arenaria verna Linnaeus.
Rather rare in the pumice on the east side of the mountain.

Arenaria macrophylla Hooker.
In dry woods at low altitudes.

PORTULACACEAE. (Purslane Family.)

Spraguea multiceps Howell.
A handsome plant, with entire spatulate leaves and dense heads of pink or purple flowers. Common in the pumice fields.

Claytonia sibirica Linnaeus.
Collected by Flett somewhere near the base of the mountain. The commonest lowland "spring beauty."

Claytonia asarifolia Bongard.
A plant with fleshy entire leaves and small racemes of white flowers. Occasional along the rivulets at 4,000 to 5,000 feet elevation.

Claytonia parvifolia Mocino.
On the rocks at 3,000 to 4,000 feet altitude.

Claytonia lanceolata Pursh.
Common in the grassy meadows. The tuberous root is edible.

Lewisia columbiana (Howell) Robinson.
Goat Mountains, Allen. Leaves fleshy, flowers rose-purple, showy.

POLYGONACEAE. (Buckwheat Family.)

Oxyria digyna (Linnaeus) Hill.
A small plant with reniform entire leaves, and flowers and fruit like those of the common docks. Not rare in rock crevices at 5,000 to 6,000 feet elevation.

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Polygonum minimum Watson.
Common at 5,000 to 6,000 feet altitude.

Polygonum douglasii Greene.
On a gravelly slope near the foot of Cowlitz Glacier.

Polygonum newberryi Small.
Common in the pumice fields, where it is a characteristic plant.

Polygonum bistortoides Pursh.
Very plentiful on the grassy slopes, where it is conspicuous by its dense white-flowered spikes an inch long, borne singly on slender stems a foot or two high.

Eriogonum compositum Douglas.
A form of this variable species occurs on the talus at the foot of the cliffs on the north side of Cowlitz Glacier.

Eriogonum pyrolaefolium coryphaeum Torrey & Gray.
Plentiful in the pumice fields.

BETULACEAE. (Birch Family.)

Alnus sinuata (Regel) Rydberg.
Sitka alder. A small alder, seldom over ten or twelve feet high. Common along the streams at low altitude.

SALICACEAE. (Willow Family.)

Salix scouleriana Barratt.
The common upland willow; not rare up to 3,500 feet elevation.

Salix sitchensis Sanson.
The "silky willow" is plentiful along the Nisqually at Longmire Springs.

Salix barclayi Anderson.
Salix commutata Bebb.
These two willows make thickets along the rills at about 6,000 feet altitude. The leaves in the former are smooth above and glaucous beneath; in the latter pubescent on both sides.

Salix nivalis Hooker.
A very dwarf willow, with obtuse leaves, growing only a few inches high. Found on the north side of the mountain by Flett.

Salix saximontana Rydberg.
Very similar to *Salix nivalis*, but larger in every way. Also found by Flett on the north side of the mountain.

Salix cascadensis Cockerell.
(*S. tenera* Andersson.)
A very dwarf rare willow with leaves acute at each end. North slope of the mountain, collected by Flett.

Populus trichocarpa Torrey & Gray.
The cottonwood occurs along the Nisqually to some distance above Longmire Springs.

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ORCHIDACEAE. (Orchis Family.)

Coraliorhiza maculata Rafinesque.
Common in the coniferous woods at low altitudes.

Corallorhiza mertensiana Bongard.
Frequent in the dense coniferous woods up to 3,500 feet.

Spiranthes romanzoffiana Chamisso.
A small form of this species was found in a bog on the summit of the ridge overlooking the foot of the Nisqually Glacier.

Peramium decipiens (Hooker) Piper.
On the trail above Longmire Springs, according to Mr. Gorman.

Limnorchis stricta (Lindley) Rydberg.
A tall plant with long spikes of greenish flowers. Not rare in wet places at 5,000 feet elevation.

Listera caurina Piper.
Common in mossy woods up to 3,500 feet.

Listera convallarioides (Swartz) Torrey.
Growing in moist woods near the foot of the mountain.

LILIACEAE. (Lily Family.)

Allium validum Watson.
This wild onion has rootstock-like bulbs. It has been found on the north side of the mountain, and only by Mr. Flett.

Vagnera sessilifolia (Baker) Greene.
Common in moist woods up to 3,000 feet altitude.

Streptopus curvipes Vail.
Common in moist woods at 3,000 feet. Distinguished from the Eastern *S. roseus* by its small size, simple stems, and creeping rootstocks.

Lilium columbianum Hanson.
The wild tiger lily occurs on dry slopes near Longmire Springs and in Paradise Park, at 5,000 feet elevation.

Fritillaria lanceolata Pursh.
Goat Mountains, Allen, No. 235.

Erythronium montanum Watson.
The white-flowered adder's tongue, so abundant in Paradise Park, up to 5,500 feet altitude.

Erythronium parviflorum (Watson) Goodding.
Much like the preceding, but the flowers yellow. Frequent along rills at 5,500 feet.

Clintonia uniflora (Schultes) Kunth.
Abundant in the coniferous forests at 2,000 to 4,000 feet altitude. Easily recognized by its tuft of two to four radical leaves, which are oblong in form, and its delicate scapes, three or four inches high, bearing a single white flower. The berry is blue.

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Trillium ovatum Pursh.
The wake-robin is plentiful at 3,000 feet altitude.

Tofieldia intermedia Rydberg.
This species has been confused with both *T. glutinosa* and *T. occidentalis*. From the former it differs principally in its seed characters, otherwise being so similar that there are no distinguishing characters in the flowering specimens. All the Cascade Mountain specimens apparently belong to *T. intermedia*, because no plant with the seed character of *T. glutinosa* has as yet been found in that range of mountains.

Veratrum viride Aiton.
The green hellebore forms considerable clumps, three or four feet high. It is frequent on moist slopes in Paradise Park.

Stenanthium occidentale Gray.
Goat Mountains, Allen, 233. Also collected on Mount Rainier by Rev. E. C. Smith, in 1890.

Xerophyllum tenax (Pursh) Nuttall.
The so-called pine-lily or bear-grass is not rare in gravelly soil in rather open woods. Straggling specimens are found up to 5,500 feet altitude.

JUNCACEAE. (Rush Family.)

Juncoides glabratum (Hooker) Sheldon.
Dry, grassy slopes at 5,000 feet.

Juncoides majus (Hooker) Piper.
(*Luzula arcuata major* Hooker.)
(*Juncoides piperi* Coville.)
The plants referred here occur at 7,000 feet altitude, in springy places. Allen, No. 44, and Piper, 2172, are identical with Tolmie's Mount Rainier specimens.

Juncoides parviflorum (Ehrhart) Coville.
Common on dry slopes up to 5,000 feet elevation.

Juncoides spicata (Linnaeus) Kuntze.
Rather rare in damp places in the pumice fields, at 8,000 feet altitude.

Juncus subtriflorus (E. Meyer) Coville.
Common at 5,000 to 6,000 feet elevation.

Juncus parryi Engelmann.
Much like the preceding, and growing along with it.

Juncus mertensianus Bongard.
Frequent along rills even up to 8,000 feet altitude.

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CYPERACEAE. (Sedge Family.)

Eriophorum polystachion Linnaeus.
This "cotton-grass" occurs in the low ground around the lakes near the base of Pinnacle Peak.

Carex paddoensis Suksdorf.
Springy places at 8,000 feet altitude; Allen, 172; Piper, 2541.

Carex pyrenaica Wahlenberg.
With the preceding; Allen, 171; Piper, 2540.

Carex phaeocephala Piper.
Dryish places at 7,500 feet elevation; Piper, 2535.

Carex preslii Bailey.
Common at 5,000 feet, along streams.

Carex pachystachya Chamisso.
This species occurs along rills in Paradise Park.

Carex nigricans Meyer.
Common at 4,000 to 6,000 feet elevation.

Carex rossii Boott.
On the grassy ridge above Sluiskin Falls.

Carex geyeri Boott.
Goat Mountains, Allen, 169.

Carex mertensii Prescott.
Rare along stream banks at about 4,000 feet altitude. Some of our specimens came from near the foot of Cowlitz Glacier.

Carex spectabilis Dewey.
(*C. invisa* Bailey.)
In wet meadows at 4,000 feet elevation.

Carex scopulorum Holm.
With the preceding.

Carex ablata Bailey.
Frequent in the meadows of Paradise Park.

Carex accedens Holm.
Paradise Park; Piper, 2550.

Carex arcta Boott.
Mount Rainier, 4,000 feet altitude; Allen 271.

Carex atrata Linnaeus.
Collected by Allen, August 14, 1895.

Carex laeviculmis Meinschausen.
In swamps near the foot of the mountain.

Carex hepburnii Boott.
A handsome little plant common at 8,000 feet altitude.

Carex kelloggii W. Boott.
Along Paradise River; Piper, 2548.

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Carex rigida Goodenough.
Allen, 269, and Piper, 2533, are referred here. The last-named specimens are from near the foot of Pinnacle Peak.

GRAMINEAE. (Grass Family.)

Phleum alpinum Linnaeus.
The "mountain timothy" is of frequent occurrence at 5,000 to 6,000 feet altitude.

Agrostis geminata Trinius.
Collected by Allen, in 1894.

Agrostis aequivalvis Trinius.
The plant referred here is common on the banks of the Paradise River up to 5,000 feet.

Agrostis rossae Vasey.
Slopes at 6,000 feet elevation; common.

Agrostis humilis Vasey.
Abundant in springy places at 8,500 feet elevation.

Calamagrostis vaseyi Beal.
Goat Mountains, Allen, and common on the rocky ridges north of Cowlitz Glacier.

Calamagrostis scabra Presl.
Not rare at 5,500 feet elevation; near Sluiskin Falls, Piper; Tatoosh Mountains, Allen.

Deschampsia atropurpurea (Wahlenberg) Scheele.
Common at 5,000 to 6,000 feet elevation.

Danthonia intermedia Vasey.
Common at about 5,000 feet altitude.

Trisetum cernuum Trinius.
Moist places up to 5,000 feet altitude.

Trisetum spicatum (Linnaeus) Richter.
Rare on the ridge near Camp of the Clouds.

Cinna latifolia (Treviranus) Grisebach.
Common in wet ground about Longmire Springs.

Poa arctica R. Brown.
A grass doubtfully referred to this species is common at 5,500 feet elevation.

Poa paddensis Williams.
One of the most frequent grasses at 5,000 to 6,000 feet.

Poa saxatilis Scribner & Williams.
On rock cliffs at 6,000 feet. The type of this species is Piper No. 1964, from above Camp of the Clouds.

Poa suksdorfii Vasey.
Rather rare in the pumice at 9,000 feet elevation.

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Poa lettermani Vasey.
On the slopes near Camp Muir, growing with the preceding.

Festuca viridula Vasey.
The finest grass on the slopes. Abundant at 5,000 feet elevation.

Festuca ovina supina (Schur) Hackel.
In the pumice fields at 8,000 feet altitude.

Festuca subulata Trinius.
Longmire Springs, in moist places.

Bromus marginatus Nees.
A species doubtfully referred here was collected on the mountains in 1890 by Rev. E. C. Smith. No specimens of it are now in our possession.

Sitanion rigidum J. G. Smith.
Pumice fields at 8,000 feet.

Sitanion glabrum J. G. Smith.
Common on the rocky ridges north of Cowlitz Glacier.

Sitanion rubescens Piper.
Dry slopes on the south side of the mountain.

SPARGANIACEAE. (Bur-reed Family.)

Sparganium minimum Fries.
Collected in 1890 by Rev. E. C. Smith, in one of the small lakes near the base of Pinnacle Peak.

TAXACEAE. (Yew Family.)

Taxus brevifolia Nuttall. Western Yew.
The yew is not uncommon along the trail from Longmire Springs to Paradise Park. It does not ascend much above 3,000 feet elevation.

PINACEAE. (Pine Family.)

Juniperus sibirica Burgsdorff. Mountain Juniper.
The alpine juniper occurs on the banks of the Nisqually, near Longmire Springs, and is common on the rocks up to 7,500 feet elevation.

Chamaecyparis nootkatensis (Lambert) Spach. Alaska Cedar.
The Alaska cedar ranges on the mountain slopes from 3,500 feet up to 6,000 feet altitude. It is far more abundant on the north side of the peak than on the south. Few, if any, specimens exceed four feet in diameter, and where the trees are most abundant the trunks are only one or two feet through.

Abies grandis Lindley. White Fir.
Some trees, without cones, which were observed on the trail above Longmire Springs, are doubtfully referred here. They are more likely to belong to the following species.

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Abies amabilis (Douglas) Forbes. Lovely Fir.

The Lovely fir is abundant at from 2,500 to 3,500 feet elevation. It is usually but a small tree, with beautifully symmetrical form. Except when fruiting, it is difficult to distinguish from the lowland white fir.

Abies nobilis Lindley. Noble Fir.

The finest of all the firs, frequently four to six feet in diameter, without a single branch for a hundred feet or more. Easily known by the deep red color of the bark when chopped into, and by the large cones, covered with reflexed bracts. Abundant at 4,000 to 5,000 feet.

Abies lasiocarpa (Hooker) Nuttall. Subalpine Fir.

This is the primly conical little fir so common in Paradise Park. It rarely occurs below 4,500 feet elevation. Its dark purple pubescent cones, only two or three inches long, readily distinguish it from the preceding species.

Pseudotsuga mucronata (Rafinesque) Sudworth. Douglas Spruce.

The Douglas spruce is common up to 3,500 feet elevation. There is a marked tendency of the cones to be relatively shorter and thicker at this altitude, but otherwise the tree shows little variation from its lowland typical form.

Tsuga heterophylla Rafinesque. Western Hemlock.

The Western hemlock is abundant at 3,000 feet altitude, but usually much smaller than when growing near the sea level.

Tsuga mertensiana (Bongard) Carriere. Black Hemlock.

The Black hemlock is frequent from 4,000 to 6,000 feet elevation. On the higher slopes it commonly forms clumps with the Subalpine fir. When this is the case, the irregular form and dark foliage of the hemlock, usually festooned with lichens, form a pleasing contrast to the conical form and lighter foliage of the fir.

Pinus albicaulis Engelmann. White-bark Pine.

This white-barked nut pine is abundant on the high ridge north of the Cowlitz Glacier. It also occurs above Camp of the Clouds. It rarely fruits, and when it does the cones, with their sweet edible seeds, are quickly torn to pieces by Clark's crow. The trunk and branches are frequently adorned with the bright yellow lichen, *Evernia vulpina.*

Pinus monticola Douglas. Western White Pine.

Not uncommon at low elevations. The narrow cones, six to twelve inches long, are characteristic.

Pinus contorta Douglas. Lodgepole Pine.

Reported by Mr. Gorman " on the moraines of the Nisqually."

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Picea engelmanni Parry. Engelmann Spruce.

Rather a rare tree about Mount Rainier, at 3,500 feet elevation. In the Sitka or Tideland spruce the leaves are decidedly flattened; in the Engelmann spruce they are nearly square in cross section.

ISOETACEAE. (Quillwort Family.)

Isoetes echinospora braunii Engelmann.

Common in the small lakes near the foot of Pinnacle Peak.

LYCOPODIACEAE. (Club-moss Family.)

Lycopodium annotinum Linnaeus.

A large patch of this handsome species occurs at the point where the trail first crosses Paradise River above Longmire Springs.

Lycopodium sitchense Ruprecht.

Common on the meadows at 4,000 feet elevation.

EQUISETACEAE. (Horsetail Family.)

Equisetum limosum Linnaeus.

This species occurs in the bog on top of the ridge above the foot of Nisqually Glacier. The old trail to the park led through this bog.

Equisetum arvense Linnaeus.

Sterile fronds of this plant were observed at Longmire Springs.

Equisetum robustum A. Braun.

Common in damp places up to 3,000 feet elevation. Readily eaten by cayuses.

POLYPODIACEAE. (Fern Family.)

Polypodium hesperium Maxon.

Not rare in rock crevices on the cliffs overlooking the lakes at the foot of Pinnacle Peak.

Phegopteris dryopteris (Linnaeus) Fee.

The pretty "oak-fern" is abundant along the trail above Longmire's, in deep woods.

Phegopteris alpestris (Hoppe) Mettenius.

Forming crown-like tufts in the talus at the foot of cliffs in Paradise Park.

Dryopteris spinulosa dilatata (Hoffman) Underwood.

The common wood-fern is frequent in the forests at 3,000 feet altitude.

Polystichum lonchitis (Linnaeus) Roth.

Specimens of this species are in my possession from Mount Rainier, but the exact place of collection has passed my recollection. Presumably it was found in or near Paradise Park.

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Filix fragilis (Linnaeus) Underwood.

Diminutive specimens of this fern were collected on the cliffs at 8,000 feet altitude. Rev. E. C. Smith found much finer examples at a lower elevation.

Cryptogramma acrostichoides R. Brown.

Common in the coarse gravel on the bars of the Nisqually, occurring even at the foot of the glacier.

OPHIOGLOSSACEAE. (Adder's Tongue Family.)

Botrychium lunaria (Linnaeus) Swartz.

Specimens were collected by Rev. E. C. Smith on the north side of the mountain in 1888.

Botrychium lanceolatum (S. G. Gmelin) Angstroem.

Longmire Springs, Allen, not otherwise known on the Pacific Coast.

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XVII. CREATION OF MOUNT RAINIER NATIONAL PARK

MEMORIAL BY SCIENTIFIC SOCIETIES

A SURPRISINGLY wide interest was awakened by the proposal to create a national park to include the great mass of Mount Rainier and its immediate surroundings. Five societies appointed committees to coöperate in securing the needed legislation from Congress. Those committees prepared a memorial. The Senate Miscellaneous Document, number 247, Fifty-third Congress, second session, shows that the memorial was introduced on July 16, 1894, by Senator Watson C. Squire from the State of Washington. The memorial was deemed of sufficient importance to be republished in the Eighteenth Annual Report of the United States Geological Survey for 1896–1897. It is here reproduced from that publication.

With all the interest thus manifested, it required nearly five years from the introduction of the memorial to witness the achievement of its purpose. The act of Congress creating the Mount Rainier National Park bears the date of March 2, 1899.

To the Senate and House of Representatives of the United States of America in Congress assembled:

At a meeting of the Geological Society of America, in Madison, Wis., August 15, 1893, a committee was appointed for the purpose of memorializing the Congress in relation to the establishment of a national park in the State of Washington to include Mount Rainier, often called Mount Tacoma. The committee consists of Dr. David T. Day, Mr. S. F. Emmons, and Mr. Bailey Willis.

At a meeting of the American Association for the Advancement of Science, in Madison, Wis., August 21, 1893, a committee was appointed by that body for the same purpose as above mentioned, consisting of

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Maj. J. W. Powell, Prof. Joseph Le Conte, Prof. I. C. Russell, Mr. B. E. Fernow, and Dr. C. H. Merriam.

At a meeting of the National Geographic Society, held in Washington, D. C., on October 13, 1893, there was appointed a committee for the purpose above mentioned, consisting of Hon. Gardiner G. Hubbard, Hon. Watson C. Squire, Mr. John W. Thompson, Miss Mary F. Waite, and Miss Eliza R. Scidmore.

At a meeting of the Sierra Club, held in San Francisco December 30, 1893, a committee for the same purpose was appointed, composed of Mr. John Muir, President D. S. Jordan, Mr. R. M. Johnson, Mr. George B. Bayley, Mr. P. B. Van Trump.

At a meeting of the Appalachian Mountain Club, held in Boston April 11, 1894, a similar committee was appointed, consisting of Mr. John Ritchie, Jr., Rev. E. C. Smith, Dr. Charles E. Fay.

The committees thus appointed were instructed by the several bodies to which they belong to coöperate in the preparation of a memorial to Congress, setting forth the substantial reasons for the establishment of such park.

Pursuant to their instructions, the committees present the following memorial to the Congress, and pray that such action may be taken by the honorable Senators and Representatives as will secure to the people of the United States the benefits of a national park which shall include the area mentioned above. In support of their prayer they beg to submit the following statement:

By proclamation of the President, in compliance with the statutes provided therefor, a Pacific Forest Reserve has been established in the State of Washington, the western portion of which is nearly coincident with the tract of land to be included in the national park for which your memorialists pray.

The western part of this reserve includes many features of unique interest and wonderful grandeur, which

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fit it peculiarly to be a national park, forever set aside for the pleasure and instruction of the people. The region is one of such exceptional rainfall and snowfall that the preservation of its forests is of unusual importance as a protection against floods in the lower valleys; but the scenic features, which mark it out for a national park, attract tourists, who set fire to the timber. This destruction goes on notwithstanding it is a forest reserve, and will continue until protection is afforded by adequate supervision of the area, whether as a reserve or park.

The reserve is traversed through the middle from north to south by the crest of the Cascade Range, which has an elevation varying from 5,300 to 6,800 feet. This is the divide between tributaries of Puget Sound, flowing west, and those of Yakima River, flowing east. Mount Rainier, the isolated volcanic peak, 14,400 feet high, stands 12 miles west of the divide, from which it is separated by a deep valley.

The eastern half of the reserve differs from the western in climate, in flora, and in fauna, in geographic and geologic features, and in aspects of scenery. The eastern slope of the Cascade Range within the reserve is a mountainous region, with summits rising to a general elevation of 6,500 to 7,600 feet above the sea. It is forest covered and presents many attractions to the tourist and hunter; but it is not peculiar among the mountain regions of America either for grandeur or interest, and it is not an essential part of the area to be set apart as a national park.

The western slope of the Cascades within the reserve is short and steep as compared with the eastern. Much of it is precipitous, particularly opposite Mount Rainier, where its bare walls would appear most grand were they not in the shadow of that overpowering peak. North and south of Rainier this slope is more gradual and densely wooded.

The western half of the Pacific reserve, that portion

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which it is proposed shall be made a national park, is characterized by Mount Rainier, whose summit is but 4 miles from the western boundary of the reserve and whose glaciers extend beyond its limits.

Mount Tacoma is not simply a volcanic cone, peculiar for its hugeness. It was formerly a vast volcanic dome, 30 miles in radius to the north, west, and south; but rivers have cut deep canyons, glaciers have carved ample amphitheaters back into the mass, and now many serrate ridges rising from a few hundred to 10,000 feet above the sea converge at that altitude to support the central pyramid, which towers more than 4,000 feet above its base.

This grand mountain is not, like Mount Blanc, merely the dominant peak of a chain of snow mountains; it is the only snow peak in view, Mount St. Helens and Mount Adams being, like it, isolated and many miles distant. Rainier is majestic in its isolation, reaching 6,000 to 8,000 feet above its neighbors. It is superb in its boldness, rising from one canyon 11,000 feet in 7 miles. Not only is it the grandest mountain in this country, it is one of the grand mountains of the world, to be named with St. Elias, Fusiyama, and Ararat, and the most superb summits of the Alps. Eminent scientists of England and Germany, who, as members of the Alpine Club of Switzerland and travelers of wide experience, would naturally be conservative in their judgment, have borne witness to the majesty of the scenery about Rainier.

In 1883 Professor Zittel, a well-known German geologist, and Prof. James Bryce, member of Parliament and author of the American Commonwealth, made a report on the scenery about Mount Rainier. Among other things, they said:

"The scenery of Mount Rainier is of rare and varied beauty. The peak itself is as noble a mountain as we have ever seen in its lines and structure. The glaciers which descend from its snow fields present all

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the characteristic features of those in the Alps, and though less extensive than the ice streams of the Mount Blanc or Monta Rosa groups are in their crevasses and séracs equally striking and equally worthy of close study. We have seen nothing more beautiful in Switzerland or Tyrol, in Norway or in the Pyrenees, than the Carbon River glaciers and the great Puyallup glaciers; indeed, the ice in the latter is unusually pure, and the crevasses unusually fine. The combination of ice scenery with woodland scenery of the grandest type is to be found nowhere in the Old World, unless it be in the Himalayas, and, so far as we know, nowhere else on the American Continent."

These eminent and experienced observers further say:

"We may perhaps be permitted to express a hope that the suggestion will at no distant date be made to Congress that Mount Rainier should, like the Yosemite Valley and the geyser region of the Upper Yellowstone, be reserved by the Federal Government and treated as a national park."

But Mount Tacoma is single not merely because it is superbly majestic; it is an arctic island in a temperate zone. In a bygone age an arctic climate prevailed over the Northwest, and glaciers covered the Cascade Range. Arctic animals and arctic plants then lived throughout the region. As the climate became milder and glaciers melted, the creatures of the cold climate were limited in their geographic range to the districts of the shrinking glaciers. On the great peak the glaciers linger still. They give to it its greatest beauty. They are themselves magnificent, and with them survives a colony of arctic animals and plants which can not exist in the temperate climate of the less lofty mountains. These arctic forms are as effectually isolated as shipwrecked sailors on an island in mid-ocean. There is no refuge for them beyond their haunts on ice-bound cliffs. But even there the birds and animals are no longer safe

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from the keen sportsman, and the few survivors must soon be exterminated unless protected by the Government in a national park.

The area of the Pacific forest reserve includes valuable timber and important water supplies. It is said to contain coal, gold, and silver.

The timber on the western slope differs from that on the eastern in size and density of growth and in kinds of trees. The forests of Puget Sound are world-renowned for the magnitude and beauty of their hemlocks, cedars, and firs. Their timber constitutes one of the most important resources of the State. Nowhere are they more luxuriant than on the foothills west and north of Mount Rainier. But their value as timber is there subordinate to their value as regulators of floods. The Puyallup River, whose lower valley is a rich hop garden, is even now subject to floods during the rapid melting of the snow on Mount Rainier in the limited area above timber line. In the broader area below timber line, but above 3,000 feet in elevation, the depth of snow in the winter of 1893 was 9 to 15 feet. Protected by the dense canopy of the fir and hemlock trees this snow melts slowly and the river is high from March to June. But let the forest be once destroyed by fire or by lumbermen and the snows of each winter, melting in early spring, will annually overwhelm the Puyallup Valley and transform it into a gravelly waste. The same is true of White River and the Nisqually.

The forests of the eastern slope, tributary to the Yakima, are of even greater importance as water preservers. They constitute a great reservoir, holding back the precipitation of the wet season and allowing it to filter down when most needed by crops. In the Yakima Valley water gives to land its value. Storage of flood waters and extensive distribution by canals is necessary. The forests being preserved to control the water, the natural storage basins should be improved and canals built. For these reasons it is most important

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that no part of the forest reserve should be sacrificed, even though the eastern half is not included in the national park.

The boundaries of the proposed national park have been so drawn as to exclude from its area all lands upon which coal, gold, or other valuable minerals are supposed to occur, and they conform to the purpose that the park shall include all features of peculiar scenic beauty without encroaching on the interests of miners or settlers.

None save those who can march and camp in the primeval forest can now visit Mount Rainier; but it is the wilderness, not the distance, that makes it difficult of approach. On the west the distance up the Nisqually River from the railroad at Yelm Prairie to the reserve is but 40 miles. Though heavily timbered, the valley of the Nisqually affords an easy route for a railroad. The Cowlitz Valley also offers a line of approach without difficulty by rail, it being about 50 miles from the railroad to the reserve.

On the northwest the railroad at Wilkeson is but 23 miles from the summit of Mount Rainier, and the glaciers can be reached by riding 25 miles through the great forest.

On the north the Cascade branch of the Northern Pacific Railroad crosses the range, only 13 miles in a direct line and 19 miles along the summit from the northern limit of the reserve.

On the east the city of North Yakima is but 62 miles from the summit of Mount Rainier.

The proposed park covers a mountain region which lies across the line of travel from east to west. The railroad winds northward; the travel down the Columbia River turns southward to avoid it. The great current of tourists which flows north and south through Portland, Tacoma, Seattle, Vancouver, and Alaska passes to the west within sight of Mount Rainier, and when the grand old mountain is obscured by clouds

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the travelers linger to see it, or, passing regretfully on their way, know that they have missed the finest view of their trip.

When a railroad is built up the Nisqually or Cowlitz Valley to the park and connection by stages is assured northward to the Cascade branch of the Northern Pacific Railroad and eastward to Yakima, the flood of travel will be diverted through the park.

The point which combines accessibility with surroundings of great beauty, and which is therefore most appropriate as a hotel site, is southeast of Mount Rainier, on one of the spurs of the Tatoosh Mountains, near the Cowlitz Valley. To open this region to travel it would be sufficient to establish the hotel and its connections down the Nisqually or Cowlitz Valley, together with trails to points of interest within the park. From the hotel a principal trail would extend north to the Emmons and White River glaciers, which would thus be easily accessible, and thence the railroad at Wilkeson could readily be reached on horseback over the old Northern Pacific trail. In the future, stage roads, or possibly a railroad, would be extended over the Cowlitz Pass to the eastern slope, North Yakima would be reached via the Tieton or Tannum Valley, and Tannum Lake would become a favorite resort.

But the highway which would challenge the world for its equal in grand scenery would extend from the Cowlitz Pass northward along the crest of the range to the Cascade branch. The distance is 50 miles, 31 in the park and 19 beyond it to the railroad. Within the reserve the summit is open and park-like. On the east is a sea of mountains; on the west is a bold descent of 3,000 feet to the valleys of Cowlitz and White rivers, beyond which Tacoma rises in overpowering grandeur, 8,000 feet above the road and only 12 miles distant.

A committee of your memorialists has carefully examined the existing maps of the State of Washington with special reference to the position of this reserve,

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and finds that the boundaries of the reserve are farther east, in relation to Mount Rainier, than was supposed. The western boundary traverses the slope of Mount Rainier at altitudes of 7,000 to 9,000 feet, and the glaciers extend several miles beyond it. In order to include all of the glacial area and the immediately adjacent forest on the west, your memorialists respectfully recommend that the western boundary of the park be drawn one range west of that of the reserve, viz, at the range line between ranges 6 and 7 east of the Willamette meridian. By this change no part of the Wilkeson-Carbonado coal field would be included in the park.

Your memorialists find, as already stated, that it is not necessary to include the eastern slope of the Cascades in the park, and furthermore that it is desirable to leave the Natchez Pass on the north and the Cowlitz Pass on the south open for the construction of railroads. Your memorialists therefore pray that the park be defined by the following boundaries: Beginning at the northwest corner of sec. 19, T. 18 N., R. 7 E. of the Willamette meridian; thence south 24 miles more or less to the southwest corner of sec. 18, T. 14 N., R. 7 E.; thence east 27 miles more or less to the summit of the Cascade Range; thence in a northerly direction to a point east of the place of beginning, and thence west 26 miles more or less to the place of beginning.

Your memorialists respectfully represent that —

Railroad lines have been surveyed and after the establishment of a national park would soon be built to its boundaries. The concessions for a hotel, stopping places, and stage routes could be leased and the proceeds devoted to the maintenance of the park. The policing of the park could be performed from the barracks at Vancouver by details of soldiers, who would thus be given useful and healthful employment from May to October.

The establishment of a hotel would afford oppor-

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tunity for a weather station, which, in view of the controlling influence exerted by Mount Rainier on the moisture-laden winds from the Pacific, would be important in relation to local weather predictions.

Your memorialists further represent that this region of marvelous beauty is even now being seriously marred by careless camping parties. Its valuable forests and rare animals are being injured and will certainly be destroyed unless the forest reserve be policed during the camping seasons. But efficient protection of the undeveloped wilderness is extraordinarily difficult and in this case practically impossible.

Therefore, for the preservation of the property of the United States, for the protection from floods of the people of Washington in the Yakima, Cowlitz, Nisqually, Puyallup, and White River valleys, and for the pleasure and education of the nation, your memorialists pray that the area above described be declared a national park forever.

For the National Geographic Society:

GARDINER G. HUBBARD,
President.

For the American Association for the Advancement of Science:

J. W. POWELL.

For the Geological Society of America:

BAILEY WILLIS.

For the Sierra Club:

JOHN MUIR.

For the Appalachian Mountain Club:

JOHN RITCHIE, JR.

WASHINGTON, D.C., *June 27, 1894.*

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XVIII. MOUNT RAINIER IS 14,408 FEET HIGH

By THE UNITED STATES GEOLOGICAL SURVEY

The United States Geological Survey issued a bulletin for newspaper publication on January 22, 1914, giving the height of the mountain as determined by the most accurate and definitive methods known. That bulletin is here given as it was then issued. At the same time F. E. Matthes, topographer with the Survey, sent additional comment to the Sierra Club of California, by whom it was published in the Sierra Bulletin for January, 1914. This comment is now reproduced by permission of the Sierra Club.

The height of the summit of Mount Rainier, Washington, has been determined by the United States Geological Survey to be 14,408 feet above mean sea level. This elevation now officially displaces the former supposed height of the mountain of 14,363 feet and accords to Mount Rainier the distinction of being the second highest mountain peak in the United States, Mount Whitney, California, being the highest. The correct height of Rainier was determined by a party of topographic engineers of the Survey in connection with the mapping of the Mount Rainier National Park, which was completed last summer. The topographic survey of the park was begun in 1910 by F. E. Matthes, continued in 1911 by Mr. Matthes and George R. Davis, and finished in 1913 by C. H. Birdseye, W. O. Tufts, O. G. Taylor, and S. E. Taylor.

In the mapping of the summit of the mountain a terrific blizzard was encountered; in fact, two ascents of the upper portion of the mountain were necessary.

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The first ascent of the upper 5,450 feet was begun at 5 o'clock A.M., August 16 [1913], and dawn broke with every indication of developing into a beautiful day. On reaching the summit the men encountered a terrific gale, clouds enveloped the mountain, preventing observations, and by noon snow began to fall. A descent was attempted, but the party became hopelessly lost in a labyrinth of crevasses, the storm developing into a blizzard. To descend further was impossible; to remain was suicide. Consequently a return to the crater was ordered, and the men reached it after a two hours' climb, utterly exhausted and nearly frozen. Here they sought shelter in one of the steam caves, where during the long night they were thoroughly steamed and half frozen in turn. Strenuous measures were employed by the men to keep from falling asleep and freezing to death. As it was, their fingers and ears were badly frozen. Finally, with a rising barometer, they succeeded in descending 9,000 feet to a temporary camp, making the descent in three hours. Here they recuperated and prepared for another ascent, which was accomplished on August 20, the start being made at 1 o'clock in the morning. Good weather was encountered and the mapping of the entire summit was finished by 1 o'clock.

"If anyone thinks that American glaciers are play glaciers, or that the weather which may be encountered at the summit of Mount Rainier in August is uniformly balmy and springlike," said Mr. Birdseye, whose fingers and ears were badly frosted, "let him climb Mount Rainier during one of its summer blizzards. The steam caves in the crater are not the pleasantest places imaginable to spend the night in, but had they not been there, not one of us would be alive today to tell the tale."

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MOUNT RAINIER IS 14,408 FEET HIGH

COMMENT BY F. E. MATTHES

The mountaineers of the Pacific Northwest will no doubt jubilate at the above announcement by the United States Geological Survey of the new figure for the altitude of Mount Rainier. It places that peak close to the top of the list of high mountains in the United States. Mount Rainier's closest rival on the Pacific coast, Mount Shasta, it so happens, has just recently been beheaded by the United States Coast and Geodetic Survey, and now can claim no more than 14,162 feet, that is, 218 feet less than it once boasted. The great volcano of Puget Sound is thus left well in the lead.

A review of the different figures that have been announced in the past for each of the higher peaks of the United States would almost justify one to infer that these summits have a peculiar habit of fluctuating in height from time to time. Both Rainier and Shasta have been notorious for their inconstancy; so much so indeed that it is to be feared that the public will lose faith somewhat in the trustworthiness of altitude determinations in general. There is good reason to believe, however, that the last announcements for these two peaks are not likely to be changed again. About Mount Shasta, perhaps the Coast Survey is the only party able to speak positively; but as regards Mount Rainier, the Geological Survey feels satisfied that the new figure is the best that can be obtained with modern methods and instruments.

The elevation of Mount Whitney (14,501 ft.), it may be remembered, was determined by actual leveling, but such procedure would have been impossible on Mount Rainier, as the most practicable route to its summit leads over many miles of snow and ice, and up a precipitous chute several hundred feet in height. On thawing snow accurate leveling is out of the question, for the instrument can not be set up so firmly that

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it will not settle slightly between back and fore sights. To execute this pottering kind of work in freezing weather would entail both hardship and great expense. But the obstacle that would have proved entirely insuperable to levels on Mount Rainier and led to the abandoning of that method is the dreaded Gibraltar Rock, well known to many who read this magazine [Sierra Club Bulletin]. To carry levels up its precipitous side is for practical considerations all but impossible.

It was necessary, in the case of Mount Rainier, to resort to long-distance methods of angulation. That is to say, sights were taken to its summit from neighboring peaks, six to eight miles distant, the altitudes of which had been carefully determined, and the positions of which with respect to the mountain's summit had been computed from a scheme of triangulation.

It is not possible to execute vertical-angle measurements of this sort with the precision obtainable by leveling; at the same time by providing a sufficient number of checks and repeating each measurement many times a result can be attained that can be relied on within a foot or two. And closer than that the determination of a snowcapped peak, such as Mount Rainier, need scarcely be; for its actual height is bound to fluctuate by several feet from year to year and even from month to month.

It is gratifying to note how closely the new trigonometric determination of Mount Rainier accords with the barometric one of Prof. Alexander McAdie (14,394 ft.). It is hoped that this agreement between the results of two fundamentally different methods will strengthen public faith in their reliability, and lead to the discarding of other figures (some of them much exaggerated) that have appeared in print from time to time.

In closing, it may be said, that the Geological Survey's bulletin little more than hints at the fortitude

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and pluck of Mr. Birdesye and his party in their almost disastrous experiences on the peak. Survey men are so frequently confronted by peril in their daily work, that they are not apt to write or talk about it, and as a consequence the public seldom learns the intimate details. It is to be hoped that the history of this undertaking will some day appear in full.

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XIX. PLACE NAMES AND ELEVATIONS IN MOUNT RAINIER NATIONAL PARK

PLACE names within a region like the Mount Rainier National Park are produced by three causes: The first and most important is the actual need of such names by those who work within the Park and by those who report upon or write about it. The second is the natural desire to honor those individuals whose achievements are worthy of commemoration. The third cause is found in the vanity of visitors. This is sometimes manifested in the harmless and often helpful desire just to be the one to name something, but usually it takes the form of a desire of visitors to write the names of themselves or their friends upon the map.

The ranger who discovers from a look-out peak a distant fire near some unnamed lake or cliff hastens to a telephone, but finds his work of sending fire fighters to the place of danger much more difficult than if he could use some definite place name. Trail builders and patrols continually find a similar need for names. For their own use they proceed to invent names which often stick. The Mountaineers in 1915 found that a trail builder had supplied such a need by giving a beautiful waterfall near his trail the name of his favorite brand of canned peaches. More care of such matters is now being exercised by those interested working through the United States Geographic Board.

The elevations given are taken from the official map and other Government publications. In time all important heights will be definitely determined and marked.

It is hoped that this compilation of the names may be improved from year to year. Further facts about any of the names would be welcomed by the editor of this work.

Ada Creek. A tributary of Huckleberry Creek near the northern boundary of the Park. Origin of name not ascertained.

Adelaide Lake. Near the north-central boundary of the Park. Origin of name not ascertained.

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PETER RAINIER.
Admiral of the Blue, Royal Navy.

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Affi Falls. In Lodi Creek, in the north-central portion of the Park. Origin of name not ascertained.

Alice Falls. In Spukwush Creek, in the northwestern portion of the Park. Origin of name not ascertained.

Alki Crest. In the northwestern corner of the Park. The name is from the Chinook jargon meaning " by and by."

Alien Lake. See Lake Allen.

Alta Vista. A point near the snow line on the south-central slope. It was named by John P. Hartman, who visited the place with a Tacoma party in 1889. The name is Spanish and means " high view."

Anvil Rock. On the southern slope, near the upper Cowlitz Glacier. The name is descriptive, but who suggested it has not been ascertained. Elevation, 9,584 feet above sea level.

Arthur Peak. In the northwestern corner of the Park. Origin of name not ascertained.

August Peak. Near the northwestern boundary of the Park. Origin of name not ascertained.

Avalanche Camp. On the north slope. Named by a member of The Mountaineers, during that club's first ascent in 1909. Elevation, 10,900 feet above sea level.

Baker Point. Outjutting portion of Goat Island Mountain, overlooking Emmons Glacier. Origin of name not ascertained.

Bald Rock. On the southeastern slope, near the Cowlitz Divide. The name is descriptive.

Barnes Pass. On western edge of the Park. Named in honor of the photographer, C. A. Barnes, who discovered it while with J. H. Weer and J. B. Flett.

Barrier Peak. A prolongation of Governors Ridge near the east-central boundary of the Park.

Basaltic Falls. On the southeastern slope of the mountain. One of the features of Cowlitz Park. Named by Prof. J. B. Flett and H. H. Garretson.

Bear Park. In the northeastern corner of the Park.

Bee Flat. In the northwestern portion of the Park, just south of Chenuis Mountain.

Beehive. Large rock on the southeast slope. It was named by Major E. S. Ingraham in 1888, who says: " It reminded me of one of those old-fashioned beehives." Elevation, 11,033 feet above sea level.

Beljica. An interesting peak near the road leading from Ashford to the Park. The name is a composite made up of initials. In July, 1897, a party of nine young people visiting the peak provided the name. The B was for Burgon D. Mesler, the e for any one of three — Elizabeth Drabe, Elizabeth Sharp and Elizabeth

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Mesler, the l for Lucy K. LaWall, the j for Jessie K. La Wall, the i for Isabel Mesler, the c for Clara Mesler, and the a for Alexander Mesler.

Bench Lake. In the southern portion of the Park. The land lying above the lake is called The Bench. Elevation of the lake, 4,500 feet above sea level.

Berkeley Park. In the north-central portion of the Park, between Burroughs and Skyscraper Mountains. Origin of name not ascertained.

Berry Peak. In the northwestern corner of the Park.

Boulder Creek. A tributary of Ohanapecosh River, in the park of the same name, on the eastern slope of the mountain.

Boundary Peak. Appropriately named, as it lies on the southern boundary line of the Park.

Brown Peak. In the northeastern corner of the Park.

Buel Peak. Near the east-central boundary of the Park. Origin of name not ascertained. Elevation, 5,933 feet above sea level.

Burnt Park. In the northeastern corner of the Park.

Burroughs Mountain. On the northeast slope. It was named for the naturalist and was at first called John Burroughs Mountain.

Butter Creek. Flowing from the Tatoosh Range across the southern boundary of the Park.

Camp Curtis. On the northeast slope. Named by The Mountaineers in 1909 in honor of Asahel Curtis, leader of that club's first ascent. Elevation, 9,000 feet above sea level.

Camp Delight. See Camp of the Stars.

Camp Misery. On the southern slope of the mountain at the base of the Beehive. The name is descriptive. Elevation, 11,033 feet above sea level.

Camp Muir. On the southeast slope. Named by Major E. S. Ingraham, in honor of the naturalist, John Muir, who selected the temporary camping place during their ascent in 1888, because the presence of pumice indicated a shelter from strong winds. Elevation, 10,062 feet above sea level.

Camp No Camp. On the southeastern slope, near the summit of the mountain. It is in the saddle near the summit of Gibraltar. The name indicates a disappointed attempt at rest. Elevation, 12,550 feet above sea level.

Camp of the Clouds. On the south slope above Paradise Valley. Named on August 12, 1886, by Charles E. Kehoe, Charles A. Billings and George N. Talcott of Olympia. During their visit there the heavy banks of clouds parted and gave them a superb mountain view. Elevation, 5,947 feet above sea level.

Camp of the Stars. On the southeastern slope of the mountain,

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near the foot of Gibraltar. It is a narrow shelf of rocks, affording space for a dozen climbers when crowded together and "feet hanging over." It was used by one of the Ingraham parties, and H. E. Holmes says they at first called it Camp Delight on account of their joy at the first rays of morning. Elevation, about 12,000 feet above sea level.

Canyon Bridge. In the southeastern part of the Park. The Muddy Fork of the Cowlitz River rushes through a very narrow and deep rift in the rocks. The spanning bridge gives an attractive view.

Carbon Glacier. This glacier begins at the foot of Willis Wall on the north face of the mountain.

Carbon River. About 1876 coal was discovered on the banks of this river suggesting the name, which was also later given to the glacier from which the river has its source.

Carter Falls. One of the beautiful features of the lower Paradise River. Named for an early guide who built the first trail to Paradise Valley. For years the Longmires collected a fee of fifty cents from each one using the trail. It was willingly paid when it was explained that the money went to the builder of the trail.

Castle Rock. In the northwestern portion of the Park. Named from its resemblance to an old castle. Elevation, 6,116 feet above sea level.

Cataract Basin. See Mist Park.

Cataract Creek. Flows from Mist Park to the Carbon River in the northwestern portion of the Park. About midway in its course are the beautiful Cataract Falls.

Cathedral Rocks. Extending southeast from the summit. It is an extensive cleaver between the upper Cowlitz and Ingraham Glaciers. Who first suggested the name has not been ascertained. Elevation, 8,262 feet above sea level.

Chenuis Mountain. An extensive ridge near the northern boundary of the Park. On the shoulders of the mountain rest three little lakes called Chenuis Lakes. From the northern slopes of the mountain there rises Chenuis Creek, which, near its junction with the Carbon River at the northwestern boundary of the Park, produces the beautiful Chenuis Falls. The name seems to be Indian, but its origin has not been ascertained. Elevation of the ridge, from 4,000 to 6,000 feet above sea level.

Christine Falls. On the lower portion of Van Trump creek. Mr. Van Trump says the falls "were named after my daughter, Christine Louise, by a friend John Hayes, of Yelm." Elevation, 3,667 feet above sea level.

Cliff Lake. In the south-central portion of the Park, between the Tatoosh Range and the boundary.

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Clover Lakes. In White River Park, in the northwestern part of the Park.

Cold Basin. In the northern portion of the Park, just south of Grand Park.

Colonnade. The ridge lying between the South Mowich and the Puyallup Glaciers on the west-central slope of the mountain.

Columbia Crest. Name suggested by H. E. Holmes of the Ingraham party in 1891. They had spent two nights in the crater and before leaving voted on a name for the highest part of the summit, with Columbia Crest as the result. It has occasionally been called The Dome. By Stevens and Van Trump it was called Crater Peak. Elevation, 14,408 feet above sea level.

Comet Falls. On the southern slope of the mountain, in Van Trump Park. Elevation, 5,200 feet above sea level.

Cougar Falls. Near the southern boundary of the Park, in the Nickel Creek tributary of the Cowlitz River.

Cowlitz Chimneys. Pointed and columnar rocks on the east-central slope. Though not adjacent to the glacier or river of that name, they undoubtedly got their name from one or the other. Elevation 7,607 feet above sea level.

Cowlitz Cleaver. Near the southern peak of the summit. It is appropriately named, as it cleaves the higher streams of ice part of which flow into Puget Sound and the rest into the Columbia River.

Cowlitz Divide. A ridge running from north to south in the southeastern corner of the Park.

Cowlitz Glacier. Named by General Hazard Stevens and P. B. Van Trump in 1870 when they discovered it to be the source of the river by that name. It has its beginning from a group of smaller glaciers on the southeast slope of the mountain. Above the glaciers lies Cowlitz Park.

Cowlitz River. The name appears as early as the Lewis and Clark reports, 1805–1806, where it is spelled Coweliskee. In varying forms it appears in the writings of all subsequent explorers. A tribe of Indians by that name inhabited its valleys. The river finally flows southward into the Columbia River.

Cowlitz Rocks. A mass of rocks on the southeast slope, between the Paradise and Cowlitz Glaciers. The rocks were named in 1907 by the veteran guide, Jules Stampfler, who found a name necessary to satisfy the curiosity of his companies of tourists. Elevation, 7,457 feet above sea level.

Crater Lake. On the northwest slope. Bailey Willis gave the name in 1883. He recently wrote: "The amphitheatres which the young geologist mistook for craters are now known to be

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glacier basins eroded by ice." Elevation, 4,929 feet above sea level.

Crater Peak. See Columbia Crest.

Crescent Mountain. On the northern slope. The name was used by Bailey Willis in 1883. Near the foot of this mountain lies Crescent Lake.

Cress Falls. In the northwestern portion of the Park, near Spukwush Creek.

Crystal Mountain. On the southwestern slope of the mountain, overlooking Indian Henrys Hunting Ground. Elevation, 6,300 feet above sea level.

Cushman Crest. On the southern slope, overlooking Nisqually Glacier. Named in honor of the late Congressman F. W. Cushman, of Tacoma.

Dege Peak. Overlooking Yakima Park in the northern part of the Park. Origin of name not ascertained.

Denman Falls. On the western slope, in St. Andrews Creek. Named by Ben Longmire in honor of A. H. Denman of Tacoma, enthusiastic mountaineer and photographer.

Devils Dream Creek. On the southern slope of the mountain, a tributary of Pyramid Creek. Origin of name not ascertained.

Dick Creek. Flowing from Elysian Fields to the Carbon River in the northwestern portion of the Park. Origin of name not ascertained.

Division Rock. At the lower end of North Mowich Glacier, on the northwestern slope of the mountain.

Doe Creek. A tributary of Ipsut Creek in the northwestern portion of the Park.

Double Peak. Near the southeastern boundary of the Park. The height is marked at 6,200 feet. The name was suggested by its form.

Eagle Cliff. Overlooking Spray Creek in the northwestern portion of the Park.

Eagle Peak. Near the south-central boundary of the Park. Elevation, 5,955 feet above sea level.

Echo Cliffs. In the northwestern portion of the Park above Cataract Creek.

Echo Rock. On the northwest slope near Russell Glacier. Major E. S. Ingraham named it Seattle Rock because it may be seen from that city. He does not know who changed the name.

Edith Creek. On the southern slope, a tributary of the Paradise River. In 1907, Jules Stampfler, the guide, was getting out a series of stereopticon views and he needed a name for that creek. He does not remember Edith's full name. She was a member of one of his parties.

Edmunds Glacier. On the western slope. In June, 1883, the

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glaciers were visited by Vice President Oakes of the Northern Pacific Railroad Company and United States Senator George F. Edmunds of Vermont. One result of that trip was an order to build what has since been known as the Bailey Willis trail to the northwestern slopes of the mountain. Another subsequent result was the naming of the glacier in honor of Senator Edmunds.

Elizabeth Ridge. Near Crater Lake in the northwestern corner of the Park. Origin of name not ascertained.

Elysian Fields. One of the beautiful park regions on the northern slope. The name was given by Major E. S. Ingraham in 1888. Elevation, 5,700 feet above sea level.

Emerald Ridge. On the southwestern slope of the mountain, dividing the lower parts of the Tahoma and South Tahoma Glaciers. The name is descriptive, but by whom it was first suggested has not been ascertained.

Emmons Glacier. On the northeastern slope. This is the largest glacier on the mountain. For a long time it was called White Glacier because it gave rise to the river of that name. The river's name came from the glacial whiteness of its waters. The present name is in honor of S. F. Emmons, who, with A. D. Wilson, made the second successful ascent of the mountain in 1870.

Eunice Lake. In the northwest corner of the Park near Tolmie Peak. Bailey Willis named it Tolmie Lake in 1883; but it was not so mapped officially, and the name was changed to honor Mrs. W. H. Gilstrap of Tacoma. She and her husband were frequent visitors to the Crater Lake region.

Fairy Falls. On the southeastern slope, in the upper waters of Stevens Creek. Elevation, 5,500 feet above sea level.

Falls Creek. Rises in North Park and flows across the boundary at the northwestern corner of the Park.

Fay Peak. In the northwestern portion of the Park, overlooking Crater Lake. Elevation, 6,500 feet above sea level. The name was given in honor of Miss Fay Fuller of Tacoma, who in 1890 was the first of her sex to attain the summit of Mount Rainier.

Fir Lake. A small lake in the southeastern corner of the Park.

Fish Creek. A tributary of Tahoma Creek in the southwestern corner of the Park.

Fishers Hornpipe Creek. On the southern slope of the mountain, a tributary of Pyramid creek. Origin of name not ascertained.

Flett Glacier. Near Ptarmigan Ridge on the northwestern slope. The name is in honor of Professor J. B. Flett of Tacoma, one of the most enthusiastic explorers of the mountain.

Florence Peak. In the northwestern corner of the Park. Origin of name not ascertained.

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Frog Heaven. On the south-central slope of the mountain, to the west of Narada Falls.

Frozen Lake. In the northern portion of the Park, just south of Mount Fremont.

Fryingpan Glacier. There are two conflicting theories about this name. One is that some campers lost a frying pan in the river, giving it that name, which was later extended to the glacier. The other is that Professor I. C. Russell named the glacier from its fancied resemblance to a frying pan, and that the name was later extended to the river. On the east-central slope of the mountain.

Garda Falls. In Granite Creek, a tributary of Winthrop Creek, in the north-central portion of the Park. Named by C. A. Barnes in honor of Miss Garda Fogg of Tacoma.

George Lake. See Lake George.

Gibraltar. This famous and forbidding cliff of rock just southeast of the summit was named by the Ingraham party in 1889. Elevation, 12,679 feet above sea level.

Glacier Basin. On the northern slope of the mountain. It is a rather steep but attractive little park, with a small lake and good spring water. Inter Glacier is at its head and Inter Fork passes through it. Miners at Starbo Camp maintain a little waterpower sawmill, and they have for years worked at prospective mines on the slopes of the Basin. They have built a wagon road to their camp, by use of which tourists will soon become well acquainted with the beauties of Glacier Basin and the surrounding regions. Elevation, 6,000 feet above sea level.

Glacier Island. On the southwestern slope of the mountain. The name is descriptive, as the island lies between the lower parts of Tahoma and South Tahoma Glaciers.

Goat Island Mountain. On the northeastern slope of the mountain, between Emmons Glacier and Summer Land.

Goat Island Rock. In the lower portion of Carbon Glacier, in the northwestern portion of the Park.

Golden Lakes. A cluster of beautiful lakes in and near Sunset Park, close to the west-central boundary of the Park. At sundown they glow like molten gold.

Gove Peak. In the northwestern portion of the Park. Origin of name not ascertained.

Governors Ridge. Toward the east-central boundary of the Park. The name was suggested by Superintendent Ethan Allen of the Park.

Grand Park. A high and extensive area in the northern portion of the Park. The miles of relatively level ground, flower-strewn and ornamented with circular groves of alpine firs and hemlocks,

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with deer abundant every summer, make the name an appropriate one. Elevation, 5,700 feet above sea level.

Granite Creek. In the north-central portion of the Park. It is a tributary of Winthrop Creek.

Grant Creek. A tributary to Spray Creek in the northwestern portion of the Park. Origin of name not ascertained.

Green Lake. In the northwestern corner of the Park.

Green Park. North of Sourdough Mountains, in the northeastern part of the Park.

Hall's Camp. See Wigwam Camp.

Hayden Creek. A tributary of Meadow Creek in the northwestern corner of the Park. Origin of name not ascertained.

Henrys Hunting Ground. See Indian Henrys Hunting Ground.

Hessong Rock. On the northwest slope overlooking Spray Park. It was named in honor of a photographer who lived at Lake Kapowsin.

Hidden Lake. Near White River Park, in the northeastern part of the Park.

Howard Peak. In the northwestern corner of the Park. Origin of name not ascertained.

Huckleberry Creek. Takes its rise in the Sourdough Mountains and flows northward across the boundary of the Park.

Huckleberry Park. At the headwaters of Huckleberry Creek in the northeastern part of the Park.

Independence Ridge. Extending from Chenuis Mountain to the northern boundary of the Park.

Indian Bar. A large gravel bar in Ohanapecosh Park on the eastern slope of the mountain.

Indian Henrys Hunting Ground. About 1870, a Cowlitz Indian began hunting mountain goats in that region. Henry Winsor, a pioneer mail carrier, asked his name and got an unpronounceable answer. "That's no name," said Winsor, "your name is Indian Henry." His playful joke stuck. On the map the word "Indian" is omitted, but the United States Geographic Board has voted to restore it. P. B. Van Trump said the Indian's name was Sotolick.

Ingraham Glacier. This beautiful glacier lies between Cathedral Rocks and Little Tahoma on the southeast slope. It was named by Professor I. C. Russell in 1896 in honor of Major E. S. Ingraham of Seattle.

Inter Glacier. On the northeast slope. It was named by Major E. S. Ingraham in 1886 when he attempted but failed to ascend the mountain from the north side. The name was suggested by the glacier being hemmed in by a rim of rocks.

Ipsut Pass. In the northwestern corner of the Park. Flowing

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from it to the Carbon River is a stream called Ipsut Creek. The word is said to be a form of an Indian word meaning " bear."

Iron Mountain. On the southwestern slope of the mountain, overlooking Indian Henrys Hunting Ground. The name describes the masses of supposed iron stain. Elevation, 6,200 feet above sea level.

Jeanette Heights. On the west-central slope overlooking Edmunds Glacier. Origin of name not ascertained.

Josephine Creek. A tributary of Huckleberry Creek, taking its rise in Green Park. Origin of name not ascertained.

June Creek. Flows across the boundary in the northwestern corner of the Park. Origin of name not ascertained.

Kautz Glacier. This glacier begins at the foot of Peak Success, the southern summit. It was named in honor of Lieutenant (afterwards General) A. V. Kautz, who attempted an ascent in 1857. The creek flowing from the glacier bears the same name.

Klapatche Ridge. Near the west-central boundary of the Park, between the North Puyallup River and St. Andrews Creek. Origin of name not ascertained.

Knapsack Pass. In the northwestern portion of the Park, a pass between Fay Peak and Mother Mountain from Mist Park to Crater Lake.

Kotsuck Creek. Flows across the east-central boundary of the Park. Origin of name not ascertained.

Lake Allen. On the west slope of Mount Wow in the southwestern corner of the Park. To avoid confusion, it was originally named Lake O. D. Allen. The name was given in honor of the veteran botanist, who was at one time a professor at Yale University.

Lake Eleanor. Near the northern boundary of the Park. Origin of name not ascertained.

Lake Ethel. In the north-central portion of the Park, with outlet into the West Fork of White River. The name was suggested by The Mountaineers in 1912 as a compliment to the daughter of Park Ranger Thomas E. O'Farrell.

Lake George. On the western slope of Mount Wow in the southwestern corner of the Park. Origin of name not ascertained.

Lake James. In the north-central portion of the Park, with outlet into Van Horn Creek. The name was suggested by The Mountaineers in 1912 as a compliment to the young son of Thomas E. O'Farrell, Park Ranger.

Lake Tom. A small lake near Arthur Peak in the northwestern corner of the Park.

Landslide. On the northwest of Slide Mountain, in the northeastern corner of the Park.

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Lee Creek. A tributary of Crater Creek in the northwestern portion of the Park. Origin of name not ascertained.

Liberty Cap. The northern peak of the summit of Mount Rainier. It has been claimed that Stevens and Van Trump gave this name at the time of their first ascent in 1870, but Mr. Van Trump says they called it Tahoma Peak. One of the early uses of the present name was by Bailey Willis, who wrote in 1883: "Over the trees near the outlet, just to the right of this pinnacle, a pure white peak towers up into the heavens; it is the northern summit of Mount Tacoma, — the Liberty Cap." Elevation, 14,112 feet above sea level.

Liberty Ridge. To the west of Willis Wall and overlooking the head of Carbon Glacier near the northern summit. The name was adopted in 1914 by the engineers of the United States Geological Survey who made the official map of the Park. It was suggested by John H. Williams, author of the book entitled "The Mountain That Was God."

Little Tahoma Peak. A towering and rugged peak on the east flank of Mount Rainier. Very few adventuresome climbers have as yet attained its summit. Elevation, 11,117 feet above sea level. The only ascent known was made by Prof. J. B. Flett and H. H. Garretson.

Lodi Creek. A tributary of White River, in the north-central portion of the Park. The name is said to have been given by early prospectors for minerals.

Longmire Springs. Near the southeastern boundary of the Park. The springs were discovered by the pioneer, James Longmire, who acquired title to the property and lived there until his death on September 17, 1897. Members of his family still maintain a resort there. The National Park Inn, a postoffice, Park offices, and other conveniences make Longmire the capital of the Park. Elevation, 2,761 feet above sea level.

Lost Creek. Flows across the northeastern boundary of the Park.

Louise Lake. In the south-central portion of the Park between Mazama Ridge and Tatoosh Range. Origin of name not ascertained.

McClure Rock. On the southeastern slope near Paradise Glacier. It marks the place of the tragic death of Professor Edgar McClure, of the University of Oregon, in 1897, while descending after taking barometric measurements at the summit. Elevation, 7,384 feet above sea level.

McNealey Peak. A part of Sourdough Mountains in the northern part of the Park. Origin of name not ascertained.

Madcap Falls. On the southern slope of the mountain, in the Paradise River between Narada Falls and Carter Falls.

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Maple Falls. In a creek of the same name, near the southern boundary of the Park. The creek is a tributary of Stevens Creek.

Marcus Peak. A part of Sourdough Mountains in the northeastern part of the Park. Origin of name not ascertained.

Margaret Falls. On the southeast slope, between Cowlitz Park and Cowlitz Glacier. The name was in honor of one of the daughters of E. S. Hall, former Superintendent of the Park.

Marie Falls. On the southeast slope, in the upper waters of Nickel Creek. Origin of name not ascertained.

Marjorie Lakes. Near the north-central boundary of the Park. Origin of name not ascertained.

Marmot Creek. A tributary of Cataract Creek, draining Seattle Park, in the northwestern portion of the Park. The name is for the whistling marmot, so plentiful in that region.

Marsh Lakes. In the southern part of the Park.

Martha Falls. On the southeast slope. The falls were named in honor of the wife of the late Elcaine Longmire, by Ben Longmire, the son.

Martin Peak. On the northwestern boundary of the Park. Origin of name not ascertained.

Mary Belle Falls. On the southeast slope in the upper waters of Nickel Creek. The name was suggested by Superintendent Ethan Allen in honor of one of the daughters of E. S. Hall, former Superintendent of the Park.

Mazama Ridge. On the southern slope of the mountain, beginning at Sluiskin Falls. Named for the Oregon mountain climbing club whose main camp was pitched there in 1905.

Meadow Creek. Near the northwestern boundary of the Park. It rises near Tolmie Peak and was named by Bailey Willis in 1883.

Mildred Point. On the southwest slope, overlooking the foot of Kautz Glacier. Origin of name not ascertained.

Mineral Mountain. On the north-central slope of the mountain, overlooking Mystic Lake. The name tells the hopes of early prospectors who worked there before the National Park was created.

Mirror Lakes. On the southwestern slope of the mountain, in Indian Henrys Hunting Ground.

Mist Park. In the northwestern portion of the Park, on the shoulders of Mother Mountain. Elevation, 6,000 feet above sea level. This park is also known as Cataract Basin.

Moraine Park. On the northern slope, bordering Carbon Glacier. It was named by Professor I. C. Russell.

Mosquito Flat. In the north-central portion of the Park, near Lakes James and Ethel. The name indicates that the place was first visited at an unfortunate season. Elevation, 4,400 feet above sea level.

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Mother Mountain. An extensive ridge in the northwestern portion of the Park. The name came from the figure of a woman in the rock on the northeastern summit of the ridge clearly seen silhouetted against the sky by those traveling on the Carbon River trail. Elevation, 6,540 feet above sea level.

Mount Ararat. On the southwest slope, overlooking Indian Henrys Hunting Ground. Ben Longmire writes: "I named it because I found there some long slabs of wood that had turned to stone and I thought they might have been part of old Noah's boat. I also found a stump with a ring around it as if his rope might have been tied there. It was all stone." Elevation, 5,996 feet above sea level.

Mount Fremont. In the northern portion of the Park at the western extremity of Sourdough Mountains. The origin of the name has not been ascertained. Elevation, 7,300 feet above sea level.

Mount Pleasant. In the northwestern portion of the Park, overlooking Mist and Spray Parks.

Mount Rainier. Named for Admiral Peter Rainier of the British Navy by Captain George Vancouver in 1792. For his own account of the discovery and naming of the mountain, see Chapter I of this book. Elevation, 14,408 feet above sea level.

Mount Ruth. On the northeastern slope of the mountain, overlooking the Inter and Emmons Glaciers. The name was given in honor of Ruth Knapp, daughter of the prospector who built "Knapp's Cabin," a landmark for tourists in the Glacier Basin region. Elevation, 8,700 feet above sea level.

Mount Wow. In the southwestern corner of the Park. It is sometimes called Goat Mountain. Elevation, 6,045 feet above sea level.

Mountain Meadows. In the northwestern corner of the Park. The name originated with Bailey Willis in 1883. Elevation, 4,000 feet above sea level.

Mowich Glaciers. On the western and northwestern slopes of the mountain are two beautiful glaciers known as North and South Mowich. The name is from the Chinook jargon, meaning "deer." Who first suggested the name has not been ascertained. Each glacier has its draining stream. These flow together, making Mowich River, which crosses the northwestern boundary of the Park. North Mowich was once called Willis Glacier and South Mowich was called Edmunds Glacier.

Muddy Fork. On the southeastern slope of the mountain. One of several sources of the Cowlitz River, it drains from the foot of the large Cowlitz Glacier.

Myrtle Falls. On the southern slope in Edith Creek, a tribu-

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tary of the Paradise River. The name was given by Jules Stampfler, the guide, in 1907. Myrtle was a member of one of his parties, but he has forgotten the rest of her name.

Mystic Lake. On the northern slope of the mountain, between the Winthrop and Carbon Glaciers. It is a favorite place for campers who expect to attempt the ascent of the mountain on its northern slopes. Elevation, 5,750 feet above sea level. Named by Prof. J. B. Flett and H. H. Garretson on account of a mysterious temporary whirlpool seen near its outlet.

Nahunta Falls. On the south slope. At one time the falls had the name Marie, but it was changed at the suggestion of Secretary Josephus Daniels of the United States Navy Department. He says: "The name was familiar to me as one given by the Carolina Tuscarora to a river in North Carolina and also to their largest fort or 'head town.'" Secretary Daniels obtained from the Bureau of American Ethnology information that the name has appeared under various spellings and may mean "tall trees" or "tall timbers."

Narada Falls. On the south-central slope, the principal feature of the lower Paradise River. An effort was recently made to change the name to Cushman Falls in honor of the late Congressman F. W. Cushman, a strong friend of the Park. The present name is of Theosophical origin. Narada was a spiritual being worshipped by the Brahman people in India by reason of his service to the first race of men. Among modern Theosophists the word has become a metaphysical subject, the greater part of which is given to esoteric students and cannot be revealed. The word itself means "uncontaminated." The wonderful beauty of the scene, in its pure and original form, suggested the name to an early group of visitors, Theosophists, consisting of the following persons: Professor E. O. Schwägerl, Mr. and Mrs. George A. Sheffield, Mr. and Mrs. Arthur Knight, Miss Ida Wright (now Mrs. Vern Mudgett), Mrs. Addie G. Barlow and Mr. Henry Carter. Elevation, 4,572 feet above sea level.

National Park Inn. At Longmire Springs near the southwestern entrance to the Park. This attractive hotel has frequently been so overrun with guests that numerous tents have been used for sleeping quarters. These are placed in the groves of pines and firs on the bank of the Nisqually River. Many trips to interesting parts of the mountain are made from the Inn. Elevation, 2,761 feet above sea level.

Natural Bridge. In the north-central portion of the Park. Many photographers have scrambled to the scene of this natural curiosity. Elevation, 5,400 feet above sea level.

Needle Creek. Near the east-central boundary of the Park.

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It is a tributary of Kotsuck Creek and takes its rise near the sharp cliffs of Cowlitz Chimneys, which may have suggested the name "Needle."

Needle Rock. On the northwest slope, overlooking the North Mowich Glacier. The name was given by Professor J. B. Flett from its supposed resemblance to Cleopatra's Needle. Elevation, 7,587 feet above sea level.

Nisqually Glacier. The large glacier flowing from the southern flank of Mount Rainier. It was named by Stevens and Van Trump in 1870 when they found it to be the source of Nisqually River.

Nisqually River. Rising at the foot of Nisqually Glacier, it flows southwesterly through the Park and empties into Puget Sound between Tacoma and Olympia. It was mentioned in the Journal of John Work of the Hudson's Bay Company, as early as 1824. The first settlement by white men on Puget Sound was made by the Hudson's Bay Company near its mouth in May, 1833. That trading post was called Nisqually House. Rev. Myron Eells, the talented missionary, says the word comes from the native word, "Squally-o-bish," from the tribe of that name.

North Mowich. See Mowich.

North Park. In the northwestern corner of the Park. Elevation, about 5,000 feet above sea level.

Northern Crags. In the northwestern portion of the Park, overlooking Elysian Fields.

Observation Rock. On the northwest slope near Flett Glacier. In 1885 it was named Observation Point by Prof. L. F. Henderson. An extensive view of western Washington is to be had from its top. Elevation, 8,364 feet above sea level.

Ohanapecosh Glacier. On the east-central slope of the mountain. Below the glacier lies the beautiful Ohanapecosh Park, from which flows the river of the same name, which passes out of the Park at the northeastern corner of the boundary. The name is Indian, but its meaning has not been ascertained.

Old Desolate. A ridge in the northwestern portion of the Park between Moraine and Vernal Parks.

Ollala Creek. In the southeastern corner of the Park. The name is from the Chinook jargon, meaning "berries."

Owyhigh Lakes. Near the east-central boundary of the Park. The Yakima had a great war leader, Chief Owhigh, and this is apparently an honor for him. See narrative by Theodore Winthrop in this book, Chapter IV.

Panhandle Gap. On the east-central slope of the mountain, above the Sarvent Glaciers. Elevation, about 7,000 feet above sea level.

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Panorama Point. On the southern slope of the mountain, overlooking Nisqually Glacier.

Paradise Glacier. On the southeast slope. In 1870, Stevens and Van Trump called it Little Nisqually Glacier.

Paradise River. Stevens and Van Trump called the river Glacier Creek in 1870.

Paradise Valley. On the south-central slope. This is the best known part of the Park. David Longmire says that his mother (wife of the pioneer, James Longmire) and a Mrs. Jameson were the first women to visit the region. As they wound up the zigzag trail through the forest they were suddenly in the midst of most wonderful mountain scenery. "O, what a paradise!" exclaimed one. "Yes, a real paradise," answered the other. That was in 1885, and the name Paradise has remained in use for the valley and has also been extended to the river and the glacier from which it takes its source.

Paul Peak. In the northwestern corner of the Park. Origin of name not ascertained.

Peak Success. The southern summit of Mount Rainier. It was named in 1870 by Stevens and Van Trump on the occasion of their making the first ascent of the mountain. The new map calls it Point Success. Elevation, 14,150 feet above sea level.

Pearl Creek. On the southern slope of the mountain, draining Pyramid Glacier into Kautz Creek. About midway in its course the creek plunges over what are known as Pearl Falls.

Pigeon Creek. Near the north-central boundary of the Park.

Pinnacle Peak. One of the most dominant peaks of the Tatoosh Range in the south-central portion of the Park. Its height is marked at 6,562 feet. On its northern slope lies an ice field called Pinnacle Glacier. The ascent of this peak is attempted by many visitors starting from Paradise Valley.

Plummer Peak. Near the south-central boundary of the Park. The name was suggested by Superintendent Ethan Allen in honor of the late Fred G. Plummer, Geographer of the United States Forest Service.

Point Success. See Peak Success.

Prospector Creek. A tributary of Huckleberry Creek in the northeastern part of the Park.

Ptarmigan Ridge. On the northwestern slope of the mountain, lying north of the North Mowich Glacier and south of the Flett and Russell Glaciers. The name was given on account of the large number of ptarmigan families found there each summer. Named by Prof. J. B. Flett and H. H. Garretson.

Puyallup Cleaver. The large ridge of rocks on the western slope of the mountain, dividing the Puyallup and Tahoma Glaciers.

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Puyallup Glacier. On the western slope. Its name comes from the fact that it feeds one of the branches of the Puyallup River.

Puyallup River. Two forks of this river rise from the glaciers on the western and southwestern slopes of the mountain. The river empties into Puget Sound at Tacoma Harbor. There have been many spellings of the word in early annals. Rev. Myron Eells says the tribe of Indians living on the river called themselves "Puyallupnamish."

Pyramid Park. On the southern slope of the mountain, adjacent to Pyramid Peak. From the park flows a stream called Pyramid Creek, and above the park lies Pyramid Glacier, between South Tahoma and Kautz Glaciers.

Pyramid Peak. On the southwestern slope, overlooking Indian Henrys Hunting Ground. It was named by James L. Mosman, of Yelm, because of its resemblance to a perfect pyramid. The same name has been extended to a small park and glacier to the northeastward of the peak. Elevation, 6,937 feet above sea level.

Rainier. See Mount Rainier.

Rampart Ridge. On the southern slope of the mountain. This ridge is a prominent group of crags rising above Longmire Springs. Elevation, 3,800 feet above sea level. The nearer and higher portion of the ridge is known as The Ramparts. The name is an old one, but who first suggested it has not been ascertained. Elevation of The Ramparts, 4,080 feet above sea level.

Ranger Creek. In the northwestern corner of the Park, flowing into Carbon River near the Ranger Station at the boundary of the Park.

Redstone Peak. In the north-central portion of the Park, between the headwaters of Van Horn Creek and White River.

Reese's Camp. On the south-central slope of the mountain, in Paradise Park. For a number of years John L. Reese has accommodated visitors in a log and canvas hotel with numerous tents for sleeping rooms. The name of his camp has grown so familiar that other names are forgotten. The site of his hotel was once known as Theosophy Ridge. Beginning with 1916, the Rainier National Park Company, a new corporation composed of prominent citizens, will supplant Reese's Camp with a modern hotel and will provide garages, lunch-stations and other conveniences for the tourists. The elevation at Reese's Camp is 5,557 feet above sea level.

Reflection Lakes. On the south-central slope of the mountain. These lakes are visited by all who make the trip to Pinnacle Peak from Paradise Valley. Elevation, 4,861 feet above sea level.

Register Rock. On the rim of the crater, where there is securely fastened in the rocks a record on which all successful climbers by

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way of the Gibraltar route sign their names. Elevation, 14,161 feet above sea level, or 247 feet below Columbia Crest, the actual summit.

Ricksecker Point. On the southern slope. It was named in honor of Eugene Ricksecker, the engineer, who had charge of building the government road in the Park. Elevation, 4,212 feet above sea level.

Round Pass. Near the southwestern boundary of the Park. It is understood that the name is to be changed to Halls Pass in honor of former Superintendent E. S. Hall.

Rushingwater Creek. Flows from the Golden Lakes across the west-central boundary of the Park.

Russell Cliff. At the summit, east of Liberty Cap. It was named by The Mountaineers Club, during an ascent in 1909, in honor of Professor I. C. Russell.

Russell Glacier. On the northern slope, just west of Carbon Glacier. It was named in honor of Professor I. C. Russell.

Rust Ridge. In the northwestern corner of the Park.

St. Andrews Park. On the southwestern slope of the mountain. Among the first campers in that region was a group of choir boys from St. Mark's (Episcopal) Church of Seattle. It is said that they called the place St. Andrews Park. The stream flowing out of it is now called St. Andrews Creek, and high up on the western slope is St. Andrews Rock, at the entrance to Sunset Amphitheatre.

St. Elmo Pass. On the north slope, through the ridge that divides the Winthrop and Inter Glaciers. It was named by Major E. S. Ingraham, who says: "In 1887, I camped on the ridge with my party. During the night a great thunderstorm arose and we could hear the peals of thunder below. A couple of boys who were with the party were sleeping above us. Suddenly they called out that the storm was over because they could see the stars. I, too, saw stars, but I did not think they were real. I got up and began to investigate. What the boys thought were stars was St. Elmo fire which had settled on their alpenstocks. Even the cooking utensils were aflame with it, and our heads shone. I explained the phenomenon and the place was called St. Elmo Pass." Elevation, 7,415 feet above sea level.

St. Jacobs Lake. A small lake in the southeastern corner of the Park. Origin of name not ascertained.

Sarvent Glaciers. Two small but interesting glaciers on the east-central slope, draining into Fryingpan Creek. They were named in honor of Henry M. Sarvent, the engineer, who made the first detailed map of the mountain.

Scarface. Near the north-central boundary of the Park. The name is descriptive. Elevation, 6,100 feet above sea level.

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Seattle Park. A small but beautiful area in the northwestern portion of the Park between the Russell and Carbon Glaciers. It was named for the City of Seattle.

Shadow Lake. On the east-central slope of the mountain, east of Burroughs Mountain. Elevation, 6,200 feet above sea level.

Shaw Creek. A tributary of White River near the eastern boundary of the Park. Origin of name not ascertained.

Silvan Island. On the south side of Emmons Glacier. Named by Prof. J. B. Flett.

Silver Falls. In the southeastern corner of the Park.

Skyscraper Mountain. In the north-central portion of the Park, overlooking Berkeley Park. It is a recent name and comes from its supposed resemblance to a modern style of architecture. Elevation, 7,650 feet above sea level.

Slide Mountain. In the northeastern corner of the Park. Elevation, 6,630 feet above sea level.

Sluiskin Falls. On the southeastern slope, in the upper waters of Paradise River. Named by Stevens and Van Trump, in 1870, in honor of their Indian guide. Elevation, 5,900 feet above sea level.

Sluiskin Mountain. In the north-central portion of the Park, overlooking Vernal Park. Evidently an additional, though later, honor for the Indian guide of Stevens and Van Trump. Elevation, 7,015 feet above sea level.

Snow Lake. Near the southern boundary of the Park.

Sotolick Point. On the southwest slope. The name is spelled "Satulick" on the map. It was suggested by P. B. Van Trump, who says Sotolick was the name of Indian Henry. Elevation, 5,574 feet above sea level.

South Mowich. See Mowich.

South Tahoma. See Tahoma.

Spray Falls. On the northwestern slope of the mountain. The highest and most beautiful falls on the north side of the mountain. It was probably named when the Bailey Willis trail was built by it in 1883. The abundant water breaks into a mass of spray. Elevation, 5,300 feet above sea level.

Spray Park. Above Spray Falls lies this extensive and most beautiful park. Its elevation is from 6,000 to 8,000 feet above sea level. Several lakes drain into Spray Creek, which produces Spray Falls. The name originated at the falls and was later extended to the creek and park.

Spukwush Creek. Flowing from Chenuis Mountain to Carbon River in the northwestern portion of the Park. The name seems to be Indian, but its origin has not been ascertained.

Squaw Lake. On the southwestern slope of the mountain, near

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the entrance to Indian Henrys Hunting Ground. It is said that the Squaw camped there while her hunter husband went further up the slopes for his game.

Starbo Camp. In Glacier Basin, on the northern slope of the mountain. It is named for the miner who has maintained a camp there for a number of years. Further information is given under the head of Glacier Basin.

Steamboat Prow. On the north slope of the mountain. The appropriateness of this name is apparent to any who have visited the upper ice fields of the Winthrop and Emmons Glaciers. The pointed cliff seems to be buffeting a sea of ice. Elevation, 9,500 feet above sea level.

Stevens Glacier. On the southeastern slope, adjoining Paradise Glacier. The name is in honor of General Hazard Stevens who, with P. B. Van Trump, made the first ascent of the mountain in 1870. The creek flowing from the glacier is called Stevens Creek; its deep bed is Stevens Canyon, and the overlooking crags are Stevens Ridge.

Stevens Peak. Near the southern boundary of the Park. The name is probably an additional honor for General Hazard Stevens. Elevation, 6,511 feet above sea level.

Success Glacier. On the southern slope of the mountain, flowing into Kautz Glacier. Between Success Glacier and South Tahoma Glacier lies a ridge called Success Cleaver. For the origin of the name see Peak Success.

Summer Land. One of the mountain's most beautiful parks, on the east-central slope, above Fryingpan Creek. It was named by Major E. S. Ingraham in 1888.

Sunbeam Falls. On the southern slope of the mountain, in a tributary of Stevens Creek.

Sunrise Ridge. Appropriately named as being at the northeastern edge of the Park. A stream flowing from the ridge is called Sunrise Creek. Elevation, about 6,000 feet above sea level.

Sunset Amphitheatre. A huge cirque extending up toward Liberty Cap on the western side of the mountain. From it flow the Puyallup and Tahoma Glaciers.

Sunset Park. So named because it extends to the west-central boundary of the Park.

Sweet Peak. In the northwestern corner of the Park. Origin of name not ascertained. Elevation, 4,500 feet above sea level.

Sylvia Falls. On the southeastern slope, in Stevens Creek. Ben Longmire, who is quite a wag, says: "Bill Stafford named some falls, Sylvia Falls, after his sweetheart, and she has not spoken to him since."

Tahoma Glacier. On the southwest slope of the mountain,

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beginning at Sunset Amphitheatre and draining into the South Fork of the Puyallup River. Just south of this glacier is another called South Tahoma Glacier, which drains into Tahoma Creek, which in turn flows into the Nisqually River at the southwestern corner of the Park. The name is one of the forms of the word Tacoma. Stevens and Van Trump gave the name to what is now known as Liberty Cap at the summit. The name is also applied to a most prominent peak on the eastern slope of the mountain. See Little Tahoma.

Tamanos Mountain. Near the east-central boundary of the Park. The name is apparently one way of spelling the Chinook jargon word meaning "spirit."

Tato Falls. On the southern slope, near the foot of Nisqually Glacier. The name was suggested by Superintendent Ethan Allen.

Tatoosh Range. Near the south-central boundary of the Park. The Indian word is said to mean "nourishing breast." A stream from the mountains is called Tatoosh Creek. Highest elevation, at Unicorn Peak, 6,939 feet above sea level.

Tenas Creek. Flowing from Mount Wow across the boundary in the southwest corner of the Park. The name is from the Chinook jargon meaning "little."

The Burn. Near the southern boundary of the Park. The name is too suggestive of a departed forest.

The Castle. A part of the Tatoosh Range, in the southern portion of the Park.

The Fan. On the southeastern slope, just south of the lower part of Cowlitz Glacier. It is a lake whose name was suggested by its shape.

The Palisades. A ridge jutting northwestward from Sourdough Mountains, in the northeastern part of the Park.

The Ramparts. See Rampart Ridge.

The Wedge. On the north slope of the mountain, between the Winthrop and Emmons Glaciers. A large mass with Steamboat Prow at the upper or "sharpened" edge. Named by Prof. I. C. Russell and his party in 1896.

Theosophy Ridge. See Reese's Camp.

Tilicum Point. On the northwestern slope of the mountain, a part of Ptarmigan Ridge. The name is from the Chinook jargon, meaning "friend." Elevation, 6,654 feet above sea level.

Tirzah Peak. A portion of Chenuis Mountain near the northwestern boundary of the Park. Origin of name not ascertained. Elevation, 5,212 feet above sea level.

Tokaloo Rock. On the western slope, at the lower end of Puyallup Cleaver. Origin of name not ascertained. Elevation, 7,675 feet above sea level.

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Tolmie Peak. In the northwestern corner of the Park. It is named in honor of Dr. William Fraser Tolmie, the Hudson's Bay Company surgeon, who was the first white man to approach the mountain. It was in 1833 that he climbed this peak. In 1883, Bailey Willis wrote: "The point remained unvisited for fifty years; last summer I was able to identify it and named it Tolmie Peak." A near-by stream is called Tolmie Creek. Elevation of the peak, 5,939 feet above sea level.

Trixie Falls. On the southeastern slope, in Cowlitz Park. The name was suggested by Superintendent Ethan Allen in honor of one of the daughters of former Superintendent E. S. Hall.

Tumtum Peak. In the southwestern corner of the Park, visible to all on the road to and from Longmire. The name is from the Chinook jargon, meaning "heart," and was suggested by the form of the mountain. Elevation, 4,678 feet above sea level.

Twin Falls. On the southeastern slope of the mountain, in the lower part of Cowlitz Park.

Tyee Peak. A part of Chenuis Mountain in the northwestern portion of the Park. The name is from the Chinook jargon, meaning "chief." Elevation, 6,030 feet above sea level.

Unicorn Peak. Where the Tatoosh Range approaches the south-central boundary of the Park, this peak rises to a height of 6,939 feet. On its western flank is an ice field called Unicorn Glacier.

Van Horn Creek. On the northern slope, toward the boundary of the Park. The name was suggested by Thomas E. O'Farrell, Park Ranger, in honor of Rev. F. J. Van Horn, one of The Mountaineers' party of 1909. The beautiful falls in the creek received the same name. Elevation of the falls, about 4,400 feet above sea level.

Van Trump Glacier. On the southern slope. It is named in honor of P. B. Van Trump who, with General Hazard Stevens, made the first ascent of the mountain in 1870. The creek flowing from the glacier has the same name, and the flower-strewn region above the creek is called Van Trump Park. Elevation of the park, about 5,500 feet above sea level.

Vernal Park. In the north-central portion of the Park, just south of Sluiskin Mountain.

Virginia Peak. Near the northwestern boundary of the Park. Origin of name not ascertained. Elevation, 4,934 feet above sea level.

Wahpenayo Peak. Between the Tatoosh Range and the south-central boundary of the Park. Origin of name not ascertained. Elevation, 6,234 feet above sea level.

Wallace Peak. A portion of Chenuis Mountain near the

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northwestern boundary of the Park. Origin of name not ascertained. Elevation, 5,800 feet above sea level.

Wapowety Cleaver. On the southern slope, overlooking Kautz Glacier. Mr. Van Trump says that Wapowety was the Indian guide of Lieutenant A. V. Kautz during his attempted ascent in 1857. Elevation, about 9,500 feet above sea level.

Washington Cascades. On the southern slope of the mountain, in the Paradise River above Narada Falls.

Wauhaukaupauken Falls. On the east slope, in Ohanapecosh Park. This is one of the remarkable features of the mountain streams. The meaning and origin of the Indian name have not been ascertained.

Weer Rock. On the western slope. The name does not appear on the map, but it is said to have been agreed upon as an honor to J. H. Weer, of Tacoma, who has done extensive exploration work upon and around the mountain. He was leader of The Mountaineers, in 1915, when the first large party encircled the mountain at snowline.

White River. This river drains most of the glaciers on the northeastern slopes of the mountain. With a grand sweep around the mountain, the river flows through its valley to unite with the Black River near Seattle, becoming the Duwamish River, which empties into Puget Sound at Seattle Harbor. Its name came from the glacial character of the water.

White River Park. Lying between Sourdough Mountains and Sunrise Ridge in the northeastern part of the Park.

Whitman Glacier. On the eastern slope of the mountain flowing from the side of Little Tahoma. The name is in honor of Doctor Marcus Whitman, who gave his life as a missionary among the Indians. He, his wife, and twelve others were murdered by the Indians near Walla Walla in 1847. The ridge of rocks east of the glacier is called Whitman Crest.

Wigwam Camp. In Indian Henrys Hunting Ground, on the southwestern slope of the mountain. For several years a tent and log-cabin camp has been maintained here by George B. Hall for the accommodation of visitors. Elevation, 5,300 feet above sea level.

Willis Wall. On the northern face of the mountain at the head of Carbon Glacier. The great vertical cliff, 3,600 feet high, over which avalanches of snow crash throughout the summer months, is one of the attractive features of the great mountain. It was named in honor of Bailey Willis, on account of his extensive explorations in 1883.

Williwakas Glacier. On the southeastern slope of the mountain, flowing from Paradise Glacier. The stream draining the

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glacier is known as Williwakas Creek. Origin of name not ascertained.

Wilson Glacier. On the southern slope, above Nisqually Glacier. It was named in honor of A. D. Wilson, who, with S. F. Emmons, made the second ascent of the mountain in 1870.

Windy Gap. In the northern portion of the Park, between the ridges of Chenuis and Crescent Mountains.

Winthrop Glacier. On the northern slope, where its head joins that of Emmons Glacier. It is named in honor of Theodore Winthrop, who passed close by the mountain in 1853 and recorded his observations in his book entitled "The Canoe and the Saddle." The same name is given to a creek that drains this glacier into White River. The glacier was formerly mapped as White Glacier.

Wright Creek. A tributary of Fryingpan Creek, taking its rise near the Cowlitz Chimneys, on the eastern slope of the mountain. Origin of name not ascertained.

Yakima Park. On the northeastern slope, on the shoulders of Sourdough Mountains. The name is that of a tribe of Indians living east of the Cascade Mountains. It has there been used as the name of a county and a city.

Yellowstone Cliffs. In the northwestern portion of the Park, at the southeastern end of Chenuis Mountain.

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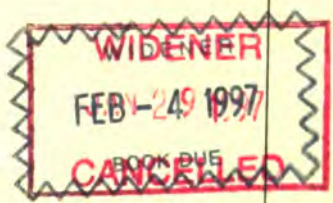

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